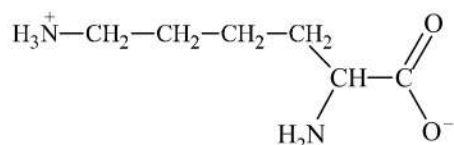


Biomolecules

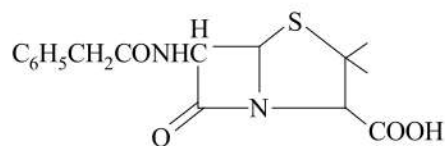
1. For 'invert sugar', the total number of correct statement(s) is(are)

(Given : specific rotations of (+) -sucrose, (+)-maltose, L-(-)-glucose and L-(+) fructose in aqueous solution are $+66^\circ$, $+140^\circ$, -52° and $+92^\circ$, respectively)

- (I) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose.
 (II) 'invert sugar' is an equimolar mixture of D-(+)-glucose and D-(-)-fructose.
 (III) specific rotation of 'invert sugar' is -20° .
 (IV) on reaction with Br_2 water, 'invert sugar' forms saccharic acid as one of the products.
2. How many dipeptides are possible from two molecules of a typical α -amino acid ?
3. The total number of basic groups in the following form of lysine is



4. A decapeptide (Mol. wt. 796) on complete hydrolysis gives glycine (Mol. wt. 75), alanine and phenylalanine. Glycine contributes 47.0% to the total weight of the hydrolysed products. Calculate the number of glycine units present in the decapeptide.
5. When the following aldohexose exists in its D-configuration, the total number of stereoisomers in its pyranose form is :
 $\text{CHO} - \text{CH}_2 - \text{CHOH} - \text{CHOH} - \text{CHOH} - \text{CH}_2\text{OH}$
6. A tetrapeptide has $-\text{COOH}$ group on alanine. This produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, find the number of possible sequences (primary structures) with $-\text{NH}_2$ group attached to a chiral center.
7. The specific optical rotations of pure α - and β -D-mannopyranose are $+29.3^\circ$ and -17.0 , respectively. When either form is dissolved in water, specific optical rotation of the equilibrium mixture is found to be $+14.2^\circ$. Calculate the percentage of α anomer at equilibrium.
8. Penicillin, the common antibiotic, has following structure :

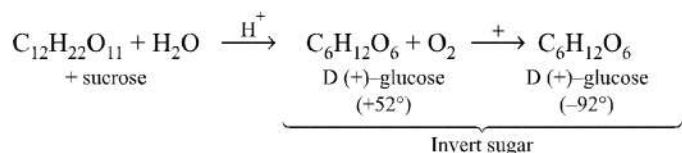


Find the number of different functional groups present in it.

9. The enzyme cytochrome C, involved in oxidation-reduction processes in the living system, has 0.43% Fe and 1.48% S. Calculate the number of S atoms in the enzyme per Fe atom.
10. A strongly alkaline solution of a monoaminodicarboxylic acid contains how many basic groups ?

SOLUTIONS

1. (2) Invert sugar is an equimolar mixture of D-(+) glucose and D(-) glucose.



$$\text{Specific rotation of invert sugar} = \frac{-92^\circ + 52^\circ}{2} = -20^\circ$$

D-glucose on oxidation with Br₂-water produces gluconic acid and not saccharic acid.

2. (1) Two molecules of an α-amino acid will form only one dipeptide, the four different dipeptides are formed when two α-amino acids are different.
3. (2) The basic groups in the given form of lysine is NH₂ (not $\overset{+}{N}H_3$) and CO₂⁻.

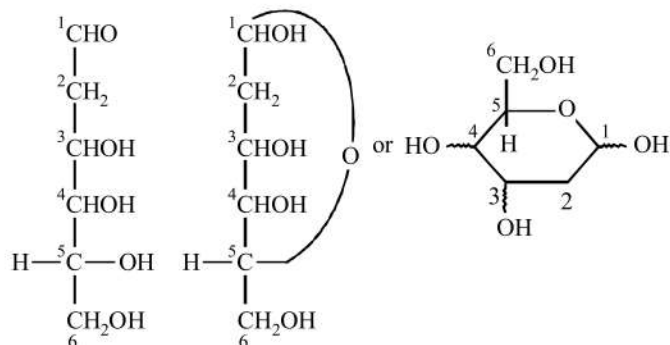
4. (6) Molecular weight of decapeptide = 796 g/mol
 Total bonds to be hydrolysed = (10 - 1) = 9 per molecule
 Total weight of H₂O added = 9 × 18 = 162 g/mol
 Total weight of hydrolysis products = 796 + 162 = 958 g
 Total weight % of glycine (given) = 47%
 Total weight of glycine in product

$$= \frac{958 \times 47}{100} \text{ g} = 450 \text{ g}$$

Molecular weight of glycine = 75 g/mol

$$\text{Number of glycine molecules} = \frac{450}{75} = 6$$

5. (8)



D- Aldohexose

D- Aldohexopyranose

Thus, total number of stereoisomers in pyranose form of D-configuration = 2³ = 8

6. (4) According to question C – Terminal must be alanine and N – Terminal do have chiral carbon means it should not be glycine. So possible sequence is :

Val Phe Gly Ala
 Val Gly Phe Ala
 Phe Val Gly Ala
 Phe Gly Val Ala

7. (67) Let fraction of a-anomer = x

$$\therefore \text{Fraction of b-anomer} = (1 - x)$$

$$\text{Hence } x(+29.3^\circ) + (1-x)(-17.0^\circ) = +14.2^\circ$$

$$29.3^\circ x + (-17^\circ + 17^\circ x) = +14.2^\circ$$

$$29.3^\circ x + 17^\circ x = 14.2^\circ + 17^\circ$$

$$46.3^\circ x = 31.2^\circ$$

$$x = 0.67$$

$$\therefore \text{Fraction of a-anomer} = 0.67 \text{ or } 67\%$$

8. (4) Amide, lactam, carboxylic and thioether linkage are present.

9. (6) The minimum atom of Fe in the enzyme is one.

0.43 g of Fe is present in 100 g of enzyme

$$56 \text{ g of Fe is present in } \frac{100}{0.43} \times 56$$

$$= 1.3 \times 10^4 \text{ g of enzyme}$$

Thus the minimum mol. wt. of the enzyme = 13000

$$\text{Similarly, 32 g of S is present in } \frac{100 \times 32}{1.48} = 2.16 \times 10^3$$

Thus the minimum mol. wt. corresponding to 1 S atom = 2160

\therefore No of S atoms in the enzyme per Fe atom

$$= \frac{13000}{2160} \approx 6$$

10. (3) In strongly alkaline solution of an amino acid, all of its —COOH groups are converted into —COO⁻. Thus a strongly alkaline solution of a monoaminodicarboxylic acid will have one —NH₂ and two —COO⁻ groups, all of which are basic in nature. Further, —NH₂ is more basic than a —COO⁻ group.