14 BIOMOLECULES

LEVEL-1

1. Which statement correctly completes the statement ?

Except for glycine, which is achiral, all the amino acids present in proteins .....

(a) are chiral, but racemic
(b) have the L configuration at their α carbon
(c) have the R configuration at their α carbon
(d) have the S configuration at their α carbon

2. Assume that a particular amino acid has an isoelectric point of 6.0. In a solution at pH 1.0, which of the following species will predominate ?

(a) $H_3\overset{+}{N}\overset{R}{\overset{|}{C}}HCO_2H$

(b) $H_2N\overset{R}{\overset{|}{C}}HCO_2H$

(c) $H_3\overset{+}{N}\overset{R}{\overset{|}{C}}HCO_2^-$

(d) $H_2N\overset{R}{\overset{|}{C}}HCO_2^-$

3. The pK_a values for the three ionizable groups X, Y and Z of glutamic acid are 4.3, 9.7 and 2.2 respectively

$$\underset{X}{HO_2C}-CH_2-\underset{\underset{+NH_3}{|}}{CH}-\underset{Z}{CO_2H}$$

The isoelectric point for the amino acid is :

(a) 7.00 (b) 3.25 (c) 4.95 (d) 5.95

4. An amino acid may be represented by general formula $H_2N-\underset{\displaystyle R}{\underset{|}{CH}}-COOH$. If $R = -CH_2C_6H_5$ then it is phenylalanine (Phe) and if $R = CH_3$ then it is alanine (Ala). Find the sequence of reagents from those given below to synthesize Phe- Ala.

(1) $ZNHCHCO_2H$ (with CH_3)

(2) $H_2NCHCO_2CH_2C_6H_5$ (with CH_3)

(3) $ZNHCHCO_2H$ (with $CH_2C_6H_5$)

(4) $H_2NCHCO_2CH_2C_6H_5$ (with $CH_2C_6H_5$)

(a) 1 and 2 (b) 1 and 4 (c) 2 and 3 (d) 3 and 4

5. Iso-electric point of alanine is (pH = 6). At which pH, maximum concentration of zwitter ion of alanine will be present ?

(a) pH > 6 (b) pH < 6 (c) pH = 6 (d) pH = 7

6. $NH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\overset{\displaystyle O}{\overset{\|}{C}}-NH-CH_2-CO_2H$

Identify the amino acid obtained by hydrolysis of the above compound:

(a) Glycine (b) Alanine (c) Both (a) and (b) (d) None of these

7. At iso-electric point :

(a) conc. of cation is equal to conc of anion

(b) Net charge is zero.

(c) Maximum conc. of di-polar ion (Zwitter ion) will be present

(d) All of the above

8. Which of following amino acid has lowest iso-electric point ?

(a) Glycine (b) Alanine (c) Aspartic acid (d) Lysine

9. Find iso-electric point of given amino acid

$CH_3-\underset{\displaystyle \overset{\oplus}{N}H_3}{\underset{|}{CH}}-CO_2H \quad pK_a = 2.2$

$pK_b = 4.4$

(a) 3.3 (b) 5.9 (c) 9.6 (d) 11.8

10. Find iso-electric point of the given amino acid

$H-O-\overset{\displaystyle O}{\overset{\|}{C}}-CH_2-CH_2-\underset{\displaystyle \overset{\oplus}{N}H_3}{\underset{|}{CH}}-CO_2H \quad (pK_a = 2)$

$(pK_a = 4)$ $(pK_a = 9)$

(a) 5.5 (b) 6.5 (c) 3 (d) 5

11. $H-C\equiv C-H \xrightarrow[H_2SO_4]{HgSO_4} (A) \xrightarrow[(2)\ H_3O^{\oplus}]{(1)\ NH_3+HCN} (B)$; Product (*B*) of given reaction is :

(a) Glycine (b) Alanine
(c) valine (d) Leucine

12. Which amino acid does not contain chiral centre ?

(a) Valine (b) Leucine (c) Glycine (d) Iso-leucine

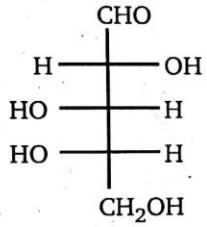
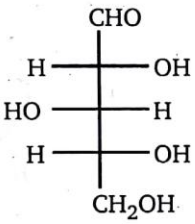
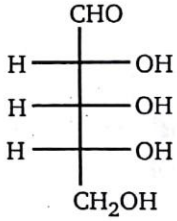
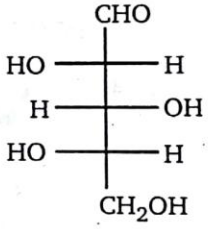
13. Which of the following is Sanger reagent ?

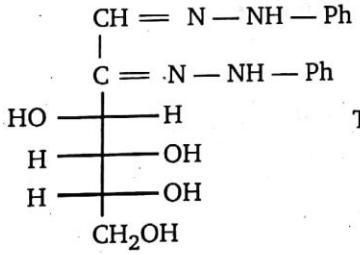
(a) 2,4-Di-nitro flurobenzene (b) Phenyl isocyanate
(c) 2, 4-Di-nitro chlorobenzene (d) 2, 4-Di-nitro iodobenzene

14. A D-carbohydrate is :

(a) Always dextrorotatory
(b) Always laevorotatory
(c) Always the mirror of the corresponding L-carbohydrate
(d) None of these

15. Which L-sugar on oxidation gives an optically active dibasic acid (2 COOH groups) ?

(a) 
(b) 
(c) 
(d) 



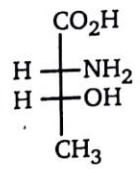
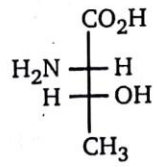
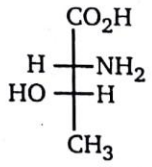
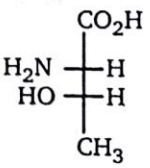
16. The given osazone can be obtained by :

(a) D-glucose (b) D-mannose (c) D-Idose (d) Both (a) & (b)

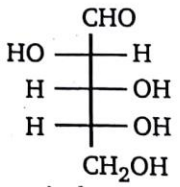
17. Which of the following pair gives same phenyl osazone ?

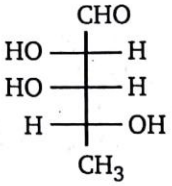
(a) D-Glucose and D-Allose (b) D-Glucose and D-Alfrose
(c) D-Glucose and D-Mannose (d) D-Glucose and D-Talose

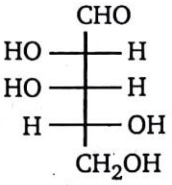
18. Which of the following is the Fischer projection of L-threonine (also known as (2S, 3R)-2-amino-3-hydroxybutanoic acid) ?

(a) 
(b) 
(c) 
(d) 

19. Among the three compounds shown below, two yield the same product on reaction with warm HNO_3. The exception is :

(a) 

(b) 

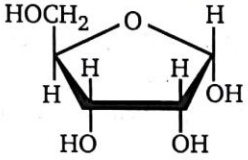
(c) 

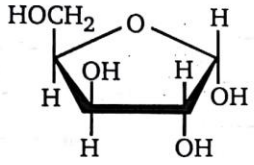
(d) None of these

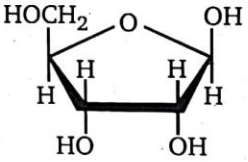
20. The optical rotation of the α- form of a pyranose is + 150.7°, that of the β- form is + 52.8°. In solution an equilibrium mixture of these anomers has an optical rotation of + 80.2°. The percentage of the α-form in equilibrium mixture is :

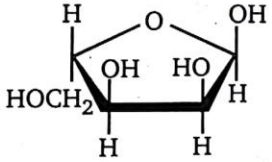
(a) 28% (b) 32 % (c) 68% (d) 72%

21. Which of the following represents the anomer of the compound shown ?



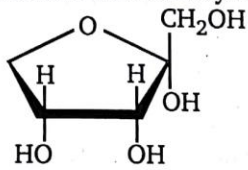
(a) 

(b) 

(c) 

(d) None of these

22. Which set of terms correctly identifies the carbohydrate shown ?



(1) Pentose (2) Pentulose (3) Hexulose (4) Hexose
(5) Aldose (6) Ketose (7) Pyranose (8) Furanose
(a) 2, 6, 8 (b) 2, 6, 7
(c) 1, 5, 8 (d) A set of terms other than these

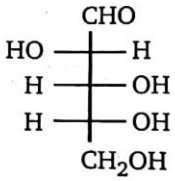
23. For the complex conversion of D-glucose into the corresponding osazone, the minimum number of equivalents of phenyl hydrazine required is :

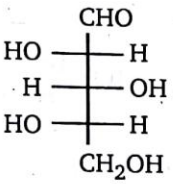
(a) two (b) three (c) four (d) five

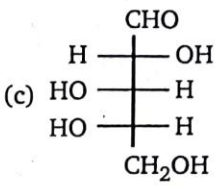
24. Which one of the following compounds will form an osazone derivative ?

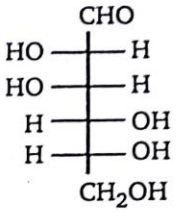
(a) $CH_3CH_2COCH_2OH$ (b) $CH_3COCH_2CH_2OH$
(c) $CH_3CH_2CHOHCH_2OH$ (d) $CH_3CH_2COCH_2OCH_3$

25. Which of the following structure is L-arabinose?

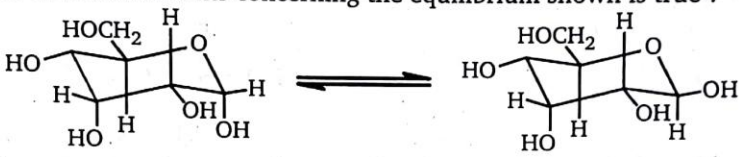
(a) 

(b) 

(c) 

(d) 

26. Which one of the statements concerning the equilibrium shown is true ?



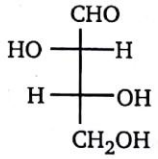
(a) The two structures are enantiomers of each other. They have equal but opposite optical rotations and recemize slowly at room temperature

(b) The two structures are enantiomers of each other. They racemize too rapidly at room temperature for their optical rotations to be measured

(c) The two structures are diastereomers of each other. Their interconversion is called mutarotation

(d) The two structures are diastereomers of each other. Their interconversion does not require breaking and making bonds, only a change in conformation

27. The configurations of the chirality centres in D-threose (shown) are :



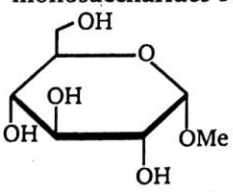
(a) 2R, 3R (b) 2R, 3S (c) 2S, 3R (d) 2S, 3S

28. Rapid interconversion of α-D-glucose and β-D-glucose in solution is known as :

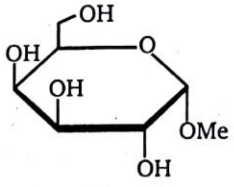
(a) racemization (b) asymmetric induction

(c) fluxional isomerization (d) mutarotation

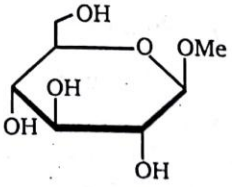
29. Identify the correct set of stereochemical relationships amongst the following monosaccharides I-IV.



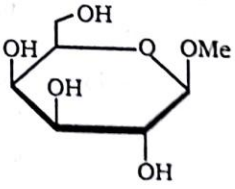
(I)



(II)



(III)



(IV)

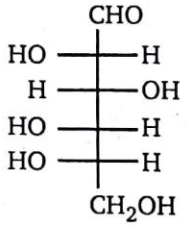
(a) I and II are anomers ; III and IV are epimers

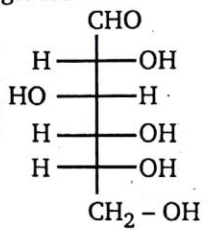
(b) I and III are epimers ; II and IV are anomers

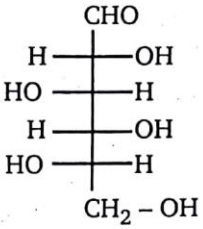
(c) I and II are epimers ; III and IV are anomers

(d) I and III are anomers ; I and II are epimers

30. What is the structure of L-glucose ?

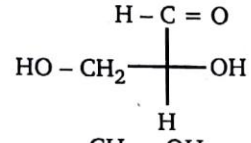
(a) 

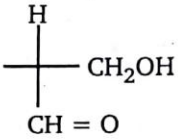
(b) 

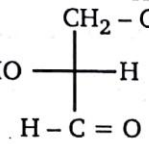
(c) 

(d) None of these

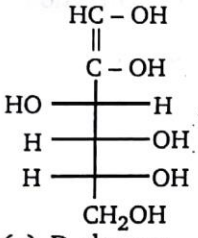
31. What is the structure of L-glyceraldehyde?

(a) 

(b) 

(c) 

(d) Both (a) and (b)

32.  , the given is enol form of :

(a) D-glucose (b) D-mannose (c) D-fructose (d) All of these

33. D-glucose $\overset{HO^-}{\rightleftharpoons}$ A + B; A and B are :

(a) D-mannose & D-mannitol (b) D-mannose & D-Fructose

(c) D-Allose & D-Altrose (d) D-Glucose & D-Idose

34. Stereoisomers of aldoheptose is (a) and stereoisomers of ketoheptose is (b). Ratio of a/b is :

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{4}{1}$ (d) $\frac{1}{4}$

35. D-Glucose $\xrightarrow[\Delta]{HNO_3}$ (A); Product (A) is :

(a) D-Gluconic acid (b) D-Glucitol (c) D-Fructose (d) D-Glucaric acid

36. D-glucose & D-fructose can be differentiated by :

(a) Fehling solution (b) Tollens reagent (c) Benedict test (d) Br_2/H_2O

37. D-Glucose exist in x different forms. The value of x (stereoisomer) is :

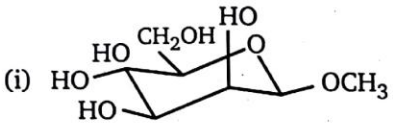
(a) 2 (b) 3 (c) 4 (d) 5

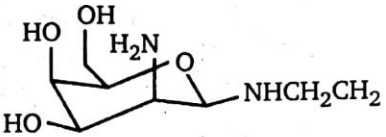
38. D-Mannose $\overset{HO^-}{\rightleftharpoons}$ D-Glucose $\overset{HO^-}{\rightleftharpoons}$ (A) ;

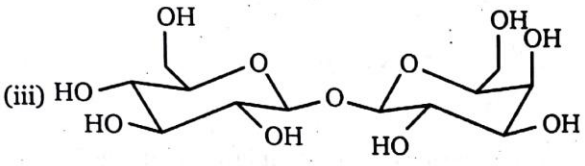
Product (A) of above reaction is

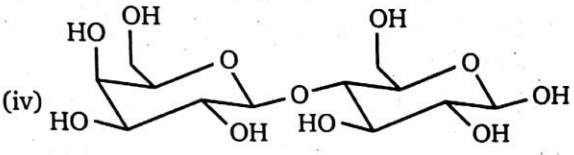
(a) D-glucose (b) D-fructose (c) D-talose (d) D-idose

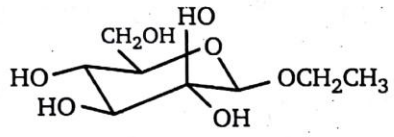
39. Which of the molecules below will react with Ag^+ ?

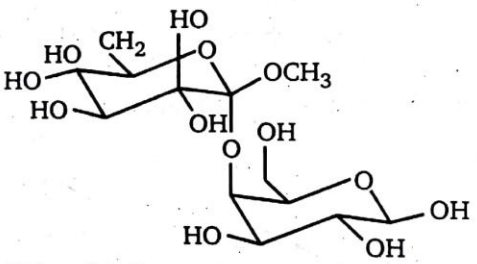
(i) 

(ii) 

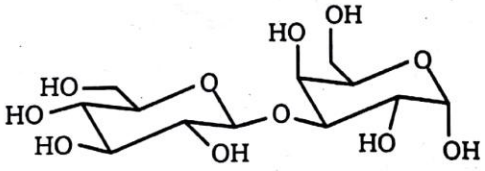
(iii) 

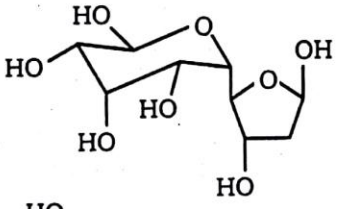
(iv) 

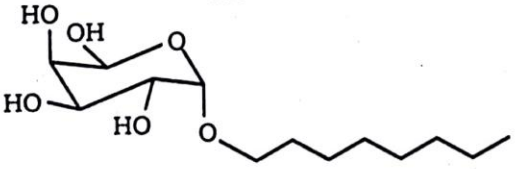
(v) 

(vi) 

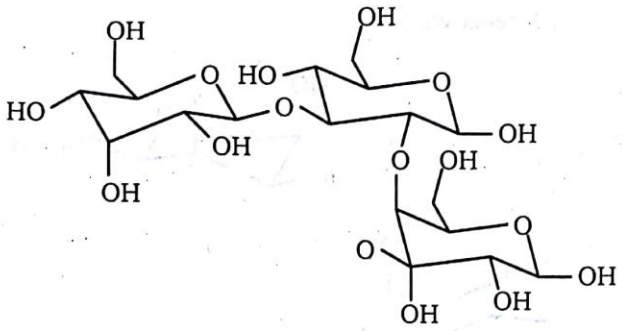
(a) (i), (iii) and (v) (b) (ii) and (iv) (c) (iv) and (vi) (d) (i), (ii), (iii) and (vi)

40. **A.** 

B. 

C. 

D.

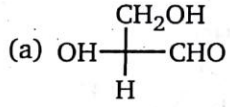
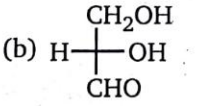
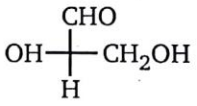
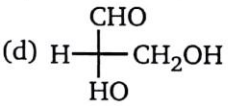


Which of the compounds (A-D) depicted above is NOT a hemiacetal linkage ?

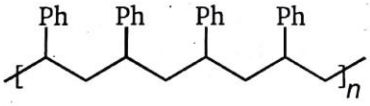
(a) Compound A (b) Compound B (c) Compound C (d) Compound D

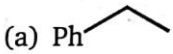
(e) None of the above (they are all hemiacetals)

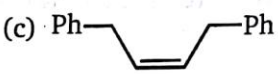
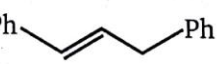
41. Which of the following Fischer projection formula is same as D-Glyceraldehyde ?

(a)  (b)  (c)  (d) 

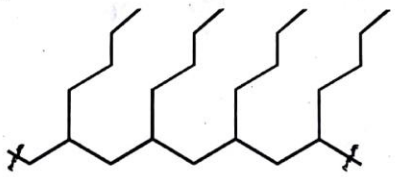
42. What is the structure of the monomer from which the following polymer was made ?

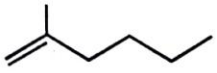


(a)  (b) 

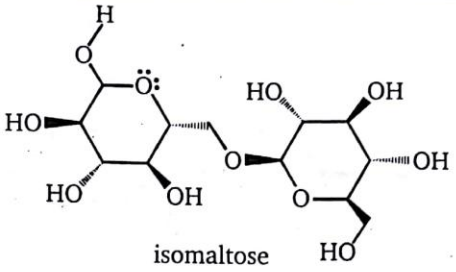
(c)  (d) 

43. The following structure represents a subunit of a hydrocarbon polymer that may be prepared by a radical polymerization method. Identify the monomer that has been polymerized to make this polymer chain.



(a)  (b)  (c)  (d) 

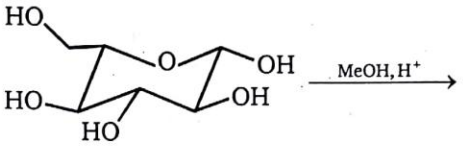
44. Choose the answer that has correctly identified the number of acetals and hemiacetals in isomaltose.

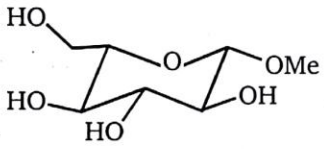


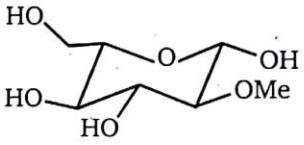
isomaltose

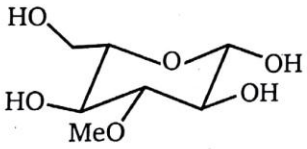
	Acetal	Hemiacetal		Acetal	Hemiacetal
(a)	0	0	(b)	1	0
(c)	0	1	(d)	1	1

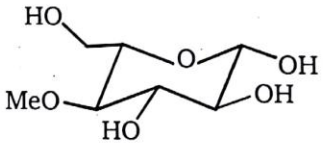
45. Predict the product of the following reaction.



(a) 

(b) 

(c) 

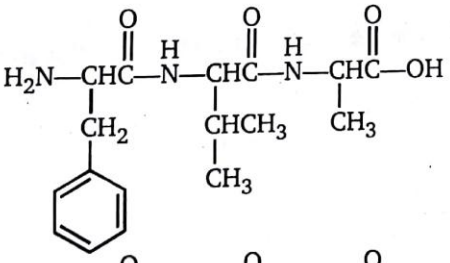
(d) 

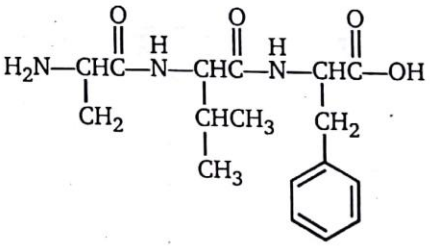
46 Which reagent/s can be used to distinguish glucose and fructose ?

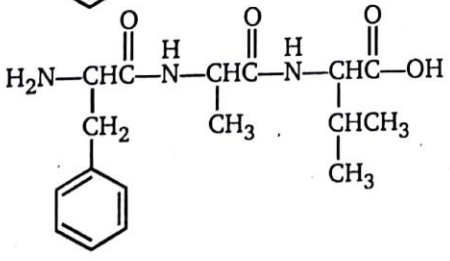
(I) Bromine water (II) Tollen's reagent (III) Schiff's reagent

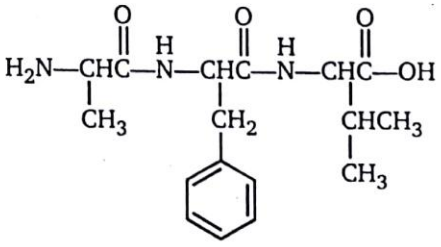
(a) (I), (II) and (III) (b) (II) and (III) (c) Only (I) (d) Only (III)

47. Choose the peptide that matches the abbreviation Phe-Val-Ala.

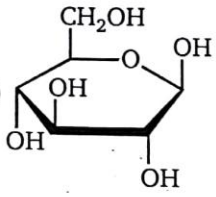
(a) 

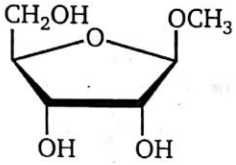
(b) 

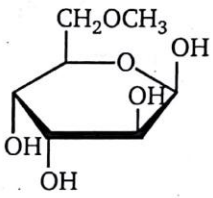
(c) 

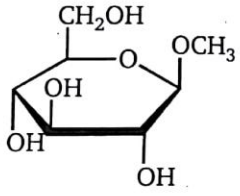
(d) 

48. Which of the following carbohydrate(s) would not undergo mutarotation in aqueous solution?

(I) 

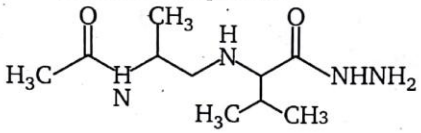
(II) 

(III) 

(IV) 

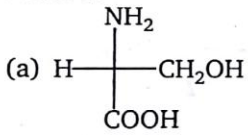
(a) II only (b) I, III and IV only (c) II and IV only (d) I and III only

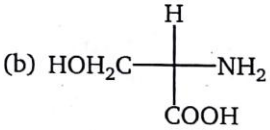
49. The number of peptide bonds in the compound.

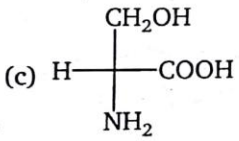


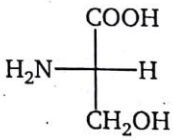
(a) 1 (b) 2 (c) 3 (d) 4

50. Serine ($HOCH_2CH(NH_2)COOH$) is an essential amino acid. The correct Fisher projection of serine is

(a) 

(b) 

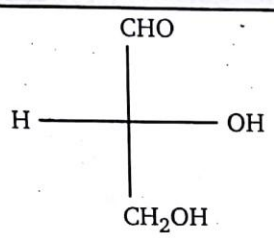
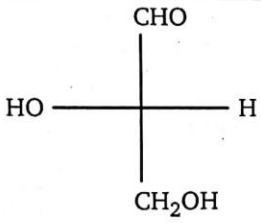
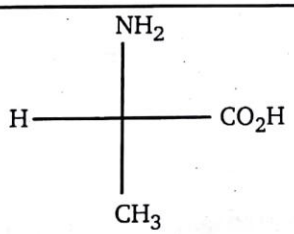
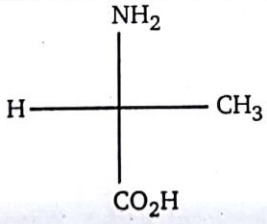
(c) 

(d) 

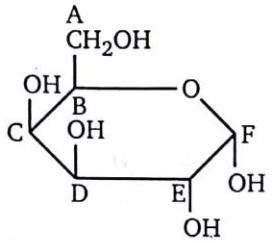
ANSWERS — LEVEL 1															
1.	(b)	**2.**	(a)	**3.**	(b)	**4.**	(b)	**5.**	(c)	**6.**	(c)	**7.**	(d)	**8.**	(c)
9.	(b)	**10.**	(c)	**11.**	(b)	**12.**	(c)	**13.**	(a)	**14.**	(d)	**15.**	(a)	**16.**	(d)
17.	(c)	**18.**	(b)	**19.**	(b)	**20.**	(a)	**21.**	(b)	**22.**	(a)	**23.**	(b)	**24.**	(a)
25.	(c)	**26.**	(c)	**27.**	(c)	**28.**	(d)	**29.**	(d)	**30.**	(a)	**31.**	(d)	**32.**	(d)
33.	(b)	**34.**	(b)	**35.**	(d)	**36.**	(d)	**37.**	(b)	**38.**	(b)	**39.**	(c)	**40.**	(e)
41.	(c)	**42.**	(b)	**43.**	(c)	**44.**	(d)	**45.**	(a)	**46.**	(c)	**47.**	(a)	**48.**	(c)
49.	(a)	**50.**	(d)												

LEVEL-2

1. Match the Column (I) and Column (II). (Matrix)

Column (I)		Column (II)	
Molecule		**Configuration**	
(a)		**(p)**	R- (Rectus)
(b)		**(q)**	S- (Sinister)
(c)		**(r)**	D
(d)		**(s)**	L

2. Comprehension



One cyclic acetal form of D-galactose is shown above.

A. Which atom is the anomeric carbon ?

(a) Atom A (b) Atom B (c) Atom C (d) Atom D

(e) Atom E (f) Atom F

B. Which name most completely describes this cyclic acetal form ?

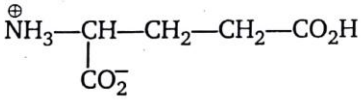
(a) α-D-Galactofuranose (b) β -P- Galactofuranose

(c) α-D- Galactopyranose (d) β -D- Galactopyranose

3. How many compound which is given below is isomer of *D*-Glucose ?

D-Mannose, *D*-Fructose, *D*-Gulose, *D*-Idose, *D*-Galactose, *D*-Arabinose, *D*-Ribose.

4. How many acidic group is present in given amino acid ?



ANSWERS — LEVEL 2

1. a – p, r; b – q, s; c – q, s; d – p, r

2. A – f; B – c

3. 5

4. 2