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Biomolecules

TOPIC 1 Carbohydrates and Lipids

1. Which one of the following statements is not true?
[Sep. 06, 2020 (II)]
(a) Lactose contains α-glycosidic linkage between C_1 of galactose and C_4 of glucose.
(b) Lactose is a reducing sugar and it gives Fehling's test.
(c) Lactose ($C_{11}H_{22}O_{11}$) is a disaccharide and it contains 8 hydroxyl groups.
(d) On acid hydrolysis, lactose gives one molecule of D(+)-glucose and one molecule of D(+)-galactose

2. The number of chiral carbons present in sucrose is _____. **[NV, Sep. 05, 2020 (II)]**

3. What are the functional groups present in the structure of maltose? **[Sep. 04, 2020 (I)]**
(a) One ketal and hemiketal
(b) Two acetals
(c) One acetal and one hemiacetal
(d) One acetal and one ketal

4. Consider the following reactions : **[Sep. 02, 2020 (I)]**

(i) Glucose + ROH $\xrightarrow{\text{dry HCl}}$ Acetal $\xrightarrow{x \text{ eq. of } (CH_3CO)_2O}$ acetyl derivative

(ii) Glucose $\xrightarrow{Ni/H_2}$ A $\xrightarrow{y \text{ eq. of } (CH_3CO)_2O}$ acetyl derivative

(iii) Glucose $\xrightarrow{z \text{ eq. of } (CH_3CO)_2O}$ acetyl derivative

'*x*', '*y*' and '*z*' in these reactions are respectively.
(a) 5, 4 & 5 (b) 4, 6 & 5
(c) 4, 5 & 5 (d) 5, 6 & 5

5. The correct observation in the following reactions is :

$$\text{Sucrose} \xrightarrow[\text{Cleavage (Hydrolysis)}]{\text{Glycosidic bond}} A + B \xrightarrow[\text{reagent}]{\text{Seliwanoff's}} ?$$

[Sep. 02, 2020 (II)]
(a) Formation of blue colour
(b) Gives no colour
(c) Formation of red colour
(d) Formation of violet colour

6. Which of the following statement is not true for glucose?
[Jan. 08, 2020 (I)]
(a) Glucose exists in two crystalline forms α and β
(b) Glucose gives Schiff's test for aldehyde
(c) Glucose reacts with hydroxylamine to form oxime
The pentaacetate of glucose does not
(d) react with hydroxylamine to give oxime

7. Two monomers in maltose are: **[Jan. 08, 2020 (II)]**
(a) α-D-glucose and β-D-glucose
(b) α-D-glucose and α-D-galactose
(c) α-D-glucose and α-D-fructose
(d) α-D-glucose and α-D-glucose

8. Which of the following statements is correct ?
[Jan. 07, 2020 (II)]
(a) Gluconic acid can form cyclic (acetal/hemiacetal) structure
(b) Gluconic acid is a dicarboxylic acid
(c) Gluconic acid is a partial oxidation product of glucose
(d) Gluconic acid is obtained by oxidation of glucose with HNO_3

9. Glucose and Galactose are having identical configuration in all the positions except position. **[April 12, 2019 (I)]**
(a) C – 3 (b) C – 4 (c) C – 2 (d) C – 5

10. Which of the given statements is INCORRECT about glycogen ? **[April 12, 2019 (II)]**
(a) It is a straight chain polymer similar to amylose.
(b) Only α-linkages are present in the molecule.
(c) It is present in animal cells.
(d) It is present in some yeast and fungi.

11. Amylopectin is composed of : **[April 10, 2019 (I)]**
(a) α-D-glucose, $C_1 - C_4$ and $C_1 - C_6$ linkages
(b) β-D-glucose, $C_1 - C_4$ and $C_2 - C_6$ linkages
(c) β-D-glucose, $C_1 - C_4$ and $C_1 - C_6$ linkages
(d) α-D-glucose, $C_1 - C_4$ and $C_2 - C_6$ linkages

12. Number of stereo centers present in linear and cyclic structures of glucose are respectively: **[April 10, 2019 (II)]**
(a) 5 & 4 (b) 4 & 4 (c) 5 & 5 (d) 4 & 5

13. Which of the following statements is not true about sucrose? **[April 9, 2019 (I)]**
(a) It is a non reducing sugar
(b) The glycosidic linkage is present between C_1 of α-glucose and C_1^- of β-fructose
(c) It is also named as invert sugar
(d) On hydrolysis, it produces glucose and fructose

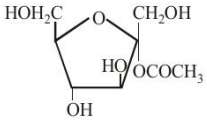
14. Maltose on treatment with dilute HCl gives : **[April 8, 2019 (I)]**
(a) D-Glucose and D-Fructose
(b) D-Fructose
(c) D-Galactose
(d) D-Glucose

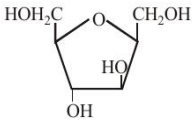
15. Fructose and glucose can be distinguished by: **[April 8, 2019 (II)]**
(a) Benedict's test (b) Fehling's test
(c) Barfoed's test (d) Seliwanoff's test

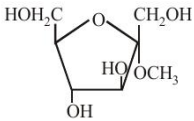
16. Glucose on prolonged heating with HI gives : **[2018]**
(a) *n*-Hexane (b) 1- Hexene
(c) Hexanoic acid (d) 6-iodohexanal

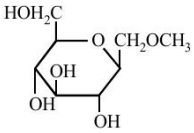
17. Among the following, the incorrect statement is: **[Online April 16, 2018]**
(a) Cellulose and amylose have 1,4-glycosidic linkage
(b) Lactose contains β-D-galactose and β-D-glucose
(c) Maltose and lactose have 1,4-glycosidic linkage
(d) Sucrose and amylose have 1,2-glycosidic linkage

18. Which of the following compounds will behave as a reducing sugar in an aqueous KOH solution? **[2017]**

(a) 

(b) 

(c) 

(d) 

19. The **incorrect** statement among the following is : **[Online April 9, 2017]**
(a) α-D-glucose and β-D-glucose are anomers.
(b) α-D-glucose and β-D-glucose are enantiomers.
(c) Cellulose is a straight chain polysaccharide made up of only β-D-glucose units.
(d) The penta acetate of glucose does not react with hydroxyl amine.

20. Complete hydrolysis of starch gives : **[Online April 10, 2015]**
(a) glucose only
(b) galactose and fructose in equimolar amounts
(c) glucose and galactose in equimolar amounts
(d) glucose and fructose in equimolar amounts

21. Accumulation of which of the following molecules in the muscles occurs as a result of vigorous exercise ? **[Online April 11, 2015]**
(a) Glycogen (b) Glucose
(c) Pyruvic acid (d) L-lactic acid

22. Which of the following will not show mutarotation? **[Online April 12, 2014]**
(a) Maltose (b) Lactose (c) Glucose (d) Sucrose

23. Synthesis of each molecule of glucose in photosynthesis involves : **[2013]**
(a) 18 molecules of ATP (b) 10 molecules of ATP
(c) 8 molecules of ATP (d) 6 molecules of ATP

24. Natural glucose is termed D-glucose because : **[Online April 23, 2013]**
(a) – OH on the second carbon is on the right side in Fischer projection
(b) – OH on the sixth carbon is on the right side in Fischer projection.
(c) – OH on the fifth carbon is on the right side in Fischer projection.
(d) It is dextrorotatory.

25. Which of the following statement is not correct? **[Online April 25, 2013]**
(a) Amylopectin is a branched polymer of α - glucose.
(b) Cellulose is a linear polymer of β-glucose
(c) Glycogen is the food reserve of plants
(d) All proteins are polymers of α - amino acids.

26. Which of the following compounds can be detected by Molisch's test ? **[2012]**
(a) Nitro compounds (b) Sugars
(c) Amines (d) Primary alcohols

27. Amylopectin is a polymer of **[Online May 12, 2012]**
(a) α – D – glucose (b) amino acid
(c) β – D – glucose (b) amylase.

28. Which of the following is a non-reducing sugar? **[Online May 19, 2012]**
(a) Lactose (b) Fructose (c) Sucrose (d) Maltose

29. Biuret test is **not** given by **[2010]**
(a) carbohydrates (b) polypeptides
(c) urea (d) proteins

30. The two functional groups present in a typical carbohydrate are: **[2009]**
(a) – CHO and – COOH (b) > C = O and – OH
(c) – OH and – CHO (d) – OH and – COOH

31. α - D-(+)-glucose and β-D-(+)-glucose are **[2008]**
(a) conformers (b) epimers
(c) anomers (d) enatiomers

32. The term anomers of glucose refers to **[2006]**
(a) enantiomers of glucose
(b) isomers of glucose that differ in configuration at carbon one (C-1)
(c) isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)
(d) a mixture of (D)-glucose and (L)-glucose

33. Complete hydrolysis of cellulose gives **[2003]**
(a) D-ribose (b) D-glucose
(c) L-glucose (d) D-fructose

TOPIC 2 Amino Acids and Proteins

34. Which of the following is not an essential amino acid? **[Sep. 05, 2020 (I)]**
(a) Tyrosine (b) Leucine
(c) Valine (d) Lysine

35. The number of chiral carbons (s) present in peptide, Ile-Age-Pro, is _____. **[NV, Sep. 05, 2020 (I)]**

36. Which of the following will react with $CHCl_3$ + alc. KOH? **[Sep. 04, 2020 (I)]**
(a) Adenine and proline (b) Thymine and proline
(c) Adenine and lysine (d) Adenine and thymine

37. The number of chiral centres present in threonine is _____. **[NV, Sep. 04, 2020 (II)]**

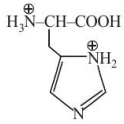
38. The number of $\rangle C=O$ groups present in a tripeptide Asp - Glu - Lys is _____. **[NV, Sep. 03, 2020 (II)]**

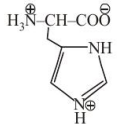
39. The mass percentage of nitrogen in histamine is _____. **[NV, Jan. 09, 2020 (I)]**

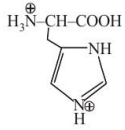
40. The peptide that gives positive ceric ammonium nitrate and carbylamine tests is: **[April 9, 2019 (II)]**
(a) Ser – Lys (b) Gln – Asp
(c) Lys – Asp (d) Asp – Gln

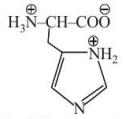
41. Among the following compounds most basic amino acid is: **[Jan. 12, 2019 (I)]**
(a) Asparagine (b) Lysine
(c) Serine (d) Histidine

42. The correct structure of histidine in a strongly acidic solution (pH = 2) is : **[Jan. 12, 2019 (II)]**

(a) 

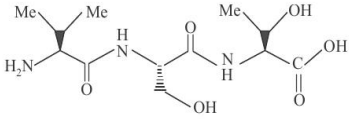
(b) 

(c) 

(d) 

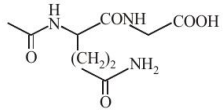
43. The increasing order of pKa of the following amino acids in aqueous solution is: **[Jan. 9, 2019 (I)]**
Gly Asp Lys Arg
(a) Asp < Gly < Arg < Lys (b) Gly < Asp < Arg < Lys
(c) Asp < Gly < Lys < Arg (d) Arg < Lys < Gly < Asp

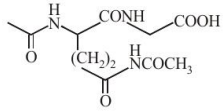
44. The correct sequence of amino acids present in the tripeptide given below is: **[Jan. 9, 2019 (II)]**

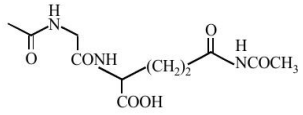


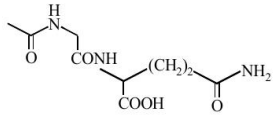
(a) Val - Ser - Thr (b) Thr - Ser - Val
(c) Leu - Ser - Val (d) Thr - Ser - Leu

45. The dipeptide, Gln-Gly, on treatment with CH_3COCl followed by aqueous work up gives: **[Online April 15, 2018 (II)]**

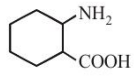
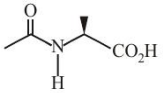
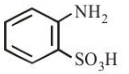
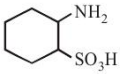
(a) 

(b) 

(c) 

(d) 

46. Which of the following will not exist in zwitter ionic form at pH = 7 ? **[Online April 15, 2018 (I)]**

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

47. Among the following, the essential amino acid is : **[Online April 8, 2017]**

(a) Alanine (b) Valine
(c) Aspartic acid (d) Serine

48. Observation of "Ruhemann's purple" is a confirmatory test for the presence of : **[Online April 10, 2016]**

(a) Starch (b) Reducing sugar
(c) Protein (d) Cupric ion

49. Glycosidic linkage is actually an : **[Online April 23, 2013]**

(a) Carbonyl bond (b) Ether bond
(c) Ester bond (d) Amide bond

50. Which one of the following statements is correct? **[2012]**

(a) All amino acids except lysine are optically active
(b) All amino acids are optically active
(c) All amino acids except glycine are optically active
(d) All amino acids except glutamic acids are optically active

51. All of the following statements apply to proteins except **[Online May 7, 2012]**

(a) Proteins generally have no definite melting point
(b) Proteins contain the grouping —CONH—
(c) Proteins have high molecular weight
(d) Proteins can only contain the elements C, H, O and N.

52. The secondary structure of a protein refers to **[2007]**

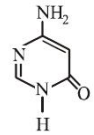
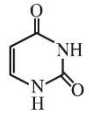
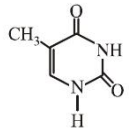
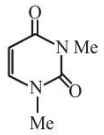
(a) fixed configuration of the polypeptide backbone
(b) α–helical backbone
(c) hydrophobic interactions
(d) sequence of α –amino acids.

TOPIC 3 Nucleic Acid and Enzymes

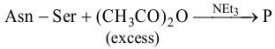
53. Which of the following statements is not true about RNA? **[April 12, 2019 (I)]**

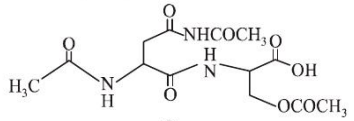
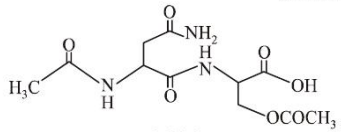
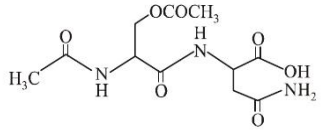
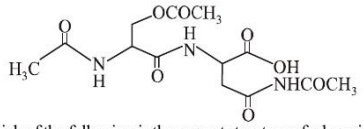
(a) It controls the synthesis of protein.
(b) It has always double stranded helix structure.
(c) It usually does not replicate.
(d) It is present in the nucleus of the cell.

54. Among the following compounds, which one is found in RNA ? **[Jan. 11, 2019 (I)]**

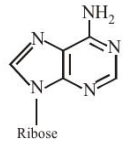
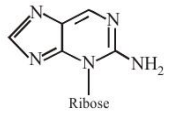
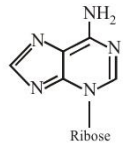
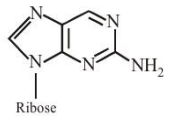
(a) 
(b) 
(c) 
(d) 

55. The correct structure of product 'P' in the following reaction is: **[Jan. 10, 2019 (I)]**



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

56. Which of the following is the correct structure of adenosine ? **[Online April 15, 2018 (I)]**

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

57. Thiol group is present in : **[2016]**

(a) Cysteine (b) Methionine
(c) Cytosine (d) Cystine

58. Which of the following bases is **not** present in DNA? **[2014]**

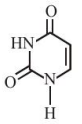
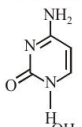
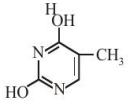
(a) Quinoline (b) Adenine
(c) Cytosine (d) Thymine

59. The reason for double helical structure of DNA is the operation of: **[Online April 19, 2014]**
(a) Electrostatic attractions
(b) van der Waals forces
(c) Dipole - Dipole interactions
(d) Hydrogen bonding

60. Among the following organic acids, the acid present in rancid butter is: **[Online April 19, 2014]**
(a) Pyruvic acid (b) Lactic acid
(c) Butyric acid (d) Acetic acid

61. Which of the following enzyme converts starch into maltose? **[Online April 9, 2013]**
(a) Diastase (b) Maltase
(c) Zymase (d) Invertase

62. Which of the following structures represents thymine ? **[Online April 22, 2013]**

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

63. Which of the following statements is correct? **[Online May 26, 2012]**
(a) RNA controls the synthesis of proteins.
(b) The sugar present in DNA is D-(–)-ribose.
(c) RNA has double stranded α-helix structure.
(d) DNA mainly occurs in the cytoplasm of the cell.

64. The pyrimidine bases present in DNA are **[2006]**
(a) cytosine and thymine (b) cytosine and uracil
(c) cytosine and adenine (d) cytosine and guanine

65. In both DNA and RNA, heterocyclic base and phosphate ester linkages are at – **[2005]**
(a) C_5' and C_1' respectively of the sugar molecule
(b) C_1' and C_5' respectively of the sugar molecule
(c) C_2' and C_5' respectively of the sugar molecule
(d) C_5' and C_2' respectively of the sugar molecule

66. Which base is present in RNA but not in DNA ? **[2004]**
(a) Guanine (b) Cytosine (c) Uracil (d) Thymine

67. The reason for double helical structure of DNA is operation of
(a) dipole-dipole interaction **[2003]**
(b) hydrogen bonding
(c) electrostatic attractions
(d) van der Waals' forces

68. RNA is different from DNA because RNA contains **[2002]**
(a) ribose sugar and thymine
(b) ribose sugar and uracil
(c) deoxyribose sugar and thymine
(d) deoxyribose sugar and uracil.

TOPIC 4 Vitamins and Hormones

69. Match the following: **[Jan. 07, 2020 (I)]**

(i) Riboflavin	(a) Beriberi
(ii) Thiamine	(b) Scurvy
(iii) Pyridoxine	(c) Cheilosis
(iv) Ascorbic acid	(d) Convulsions

(a) (i) – (a), (ii) – (d), (iii) – (c), (iv) – (b)
(b) (i) – (c), (ii) – (d), (iii) – (a), (iv) – (b)
(c) (i) – (c), (ii) – (a), (iii) – (d), (iv) – (b)
(d) (i) – (d), (ii) – (b), (iii) – (a), (iv) – (c)

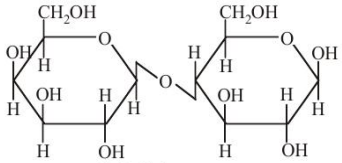
70. Which of the vitamins given below is water soluble ?
(a) Vitamin E (b) Vitamin K **[2015]**
(c) Vitamin C (d) Vitamin D

71. Among the following vitamins the one whose deficiency causes rickets (bone deficiency) is **[Online April 25, 2013]**
(a) Vitamin A (b) Vitamin B
(c) Vitamin D (d) Vitamin C

72. Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories ? **[2004]**
(a) An enzyme (b) A hormone
(c) A co-enzyme (d) An antibiotic

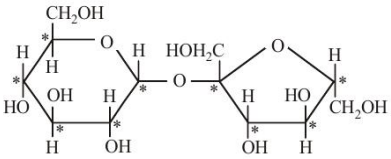
Hints & Solutions

1. **(a)** Lactose contains β -glycosidic linkage between C_1 of galactose and C_4 of glucose.



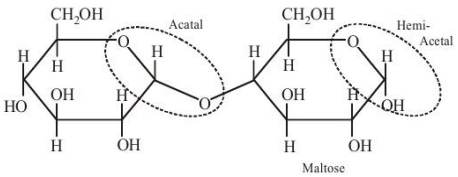
β -D-Galactose

2. **(9)**



No. of chiral centres = 9.

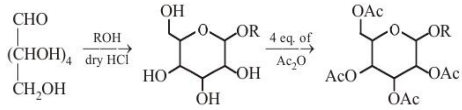
3. **(c)**



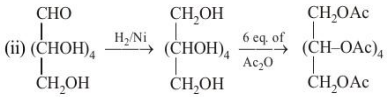
Maltose

One acetal and one hemi acetal group is present in maltose.

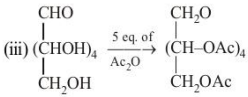
4. **(b)** (i)



(ii)



(iii)



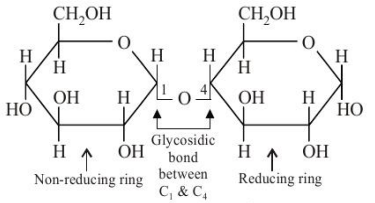
Thus $x = 4$, $y = 6$ and $z = 5$

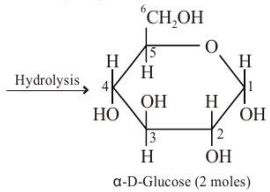
5. **(c)** Seliwanoff reagent → [Resorcinol + Conc. HCl]

It is used to distinguish aldoses and ketoses. Ketoses show red colour whereas aldoses show light pink colour with Seliwanoff Reagent.

6. **(b)** Glucose exists in cyclic form in which aldehyde group is not free, therefore it does not give Schiff's test.

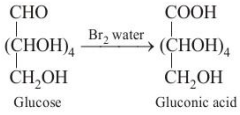
7. **(d)** Maltose on hydrolysis gives two moles of α-D-glucose.





α-D-Glucose (2 moles)

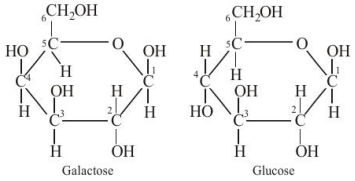
8. **(c)** Gluconic acid is obtained by partial oxidation of glucose by mild oxidising agent e.g. Tollen's reagent, Fehling solution, Br_2 water.



Glucose Gluconic acid

Gluconic acid can not form hemiacetal or acetal.

9. **(b)** Galactose and glucose are C_4 epimers.



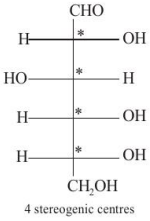
10. **(a)** Structure of glycogen is similar to amylopectin. It is found in yeast and fungi and stored in animal body. It contains α-glycosidic linkages.

11. **(a)** Starch is a polymer of α-D-glucose. It has two components.

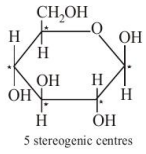
(i) Amylose, which has only α-1, 4-glycosidic linkage and is a linear polymer.

(ii) Amylopectin, which has α-1, 6-glycosidic linkage in addition to α-1, 4-glycosidic linkage and is a cross-linked polymer.

12. **(d)** Linear structure of glucose,



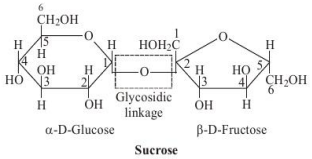
Cyclic structure of glucose,



Here, * represents stereocenters.

13. **(b)** Sucrose contains glycosidic link between C_1 of α-D glucose and C_2 of β-D-fructose.

$$C_{12}H_{22}O_{11} + H_2O \longrightarrow \text{Glucose} + \text{Fructose}$$



Sucrose

14. **(d)** Hydrolysis of maltose gives glucose as maltose is composed of two α-D glucose units.

15. **(d)**

(a) Fehling solution : $CuSO_4$ + Sod. – Pot. tartarate (Rochelle salt) gives red ppt. of Cu_2O with glucose and fructose both.

(b) Barfoed reagent : $7\%(CH_3COO)_2Cu + 1\%\, CH_3COOH + 92\%\, H_2O$ gives red ppt. of Cu_2O with both.

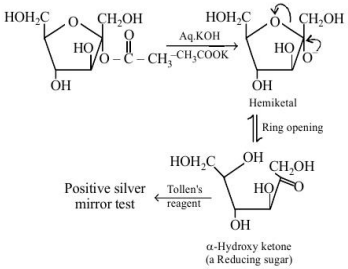
(c) Benedict reagent : $CuSO_4$ + Sod. citrate + Na_2CO_3 also gives red ppt. of Cu_2O with both.

(d) Seliwanoff's reagent : Resorcinol in conc. HCl gives red colour with both, but a ketose (fructose) reacts more quickly than an aldose (glucose).

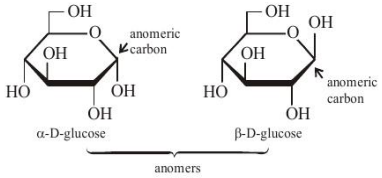
16. **(a)** $(CHOH)_4$ (CHO, CH_2OH) $\xrightarrow{HI,\ \Delta}$ $CH_3CH_2CH_2CH_2CH_2CH_3$ (*n*-Hexane)

17. **(d)** In amylose 1, 4-α-glycosidic linkage is present.

18. **(a)**

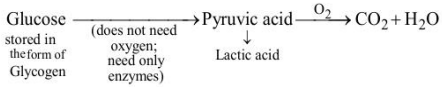


19. (b)



20. (a) Starch is a mixture of amylose & amylopectin polysaccharides and monomer is glucose. Thus on complete hydrolysis it gives only glucose.

21. (d)



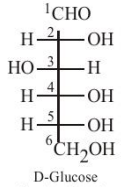
During vigorous exercise sufficient oxygen is not available to meet the energy demand, so energy is derived through conversion of pyruvic acid to lactic acid.

22. (d) Sucrose does not contain a free aldehydic or ketonic group, hence it does not show mutarotation.

23. (a) $6CO_2 + 12NADPH + 18ATP \longrightarrow C_6H_{12}O_6 + 12NADP + 18ADP$

24. (c) Fischer gave the prefix "D" to compounds whose bottom chiral has its OH to the right. So natural glucose is called D-glucose or dextrose.

Structure of D-Glucose :



D-Glucose

25. (c) Glycogen is called animal starch and is found in all animal cells. It constitutes the reserve food material.

26. (b) **Molisch's test :** This is a general test for carbohydrates. One or two drops of alcoholic solution of α-naphthol is added to 2 mL glucose solution, 1 mL of conc. H_2SO_4 solution is added carefully along the sides of the test-tube. The formation of a violet ring at the junction of two liquids confirms the presence of a carbohydrate or sugar.

27. (a) Amylopectin is a polymer of α-D-glucose.

28. (c) Sucrose is a non-reducing sugar as it does not reduce Fehling reagent and Tollen's reagent.

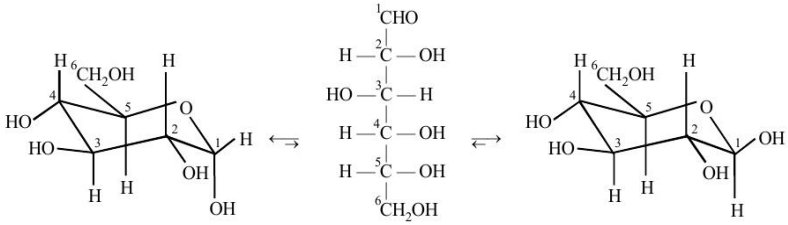
29. (a) Biuret test produces violet colour on addition of dilute $CuSO_4$ to alkaline solution of a compound containing peptide linkage.

Polypeptides, proteins and urea have $-CO-\underset{\underset{O}{\|}}{}-NH-$ (peptide) linkage, while carbohydrates have glycosidic llinkages. So, test of carbohydtrates should be different from that of other three.

30. (c) **Note:** Glucose is considered as a typical carbohydrate which contains –CHO and –OH groups.

31. (c)

32. (b) Cyclization of the open chain structure of D-(+)-glucose has created a new stereocenter at C_1 which explains the existence of two cyclic forms of D-(+)-glucose, namely α– and β–. These two cyclic forms are *diasteromers, such diastereomers which differ only in the configuration of chiral carbon developed on hemiacetal formation* (it is C_1 in glucose and C_2 in fructose) *are called* **anomers** and the hemiacetal carbon (C_1 or C_2) is called the **anomeric carbon.**

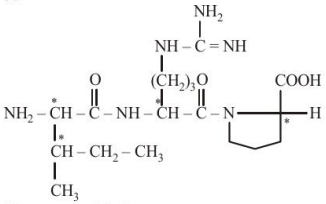


33. **(b)** Cellulose is a linear polymer of β–D– glucose in which C_1 of one glucose unit is connected to C_4 of the other through β–D glucosidic linkage. It does not undergo hydrolysis easily. However on heating with dilute H_2SO_4 under pressure, it undergoes hydrolysis to give only D–glucose.

$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow{H^+} \underset{\text{D-Glucose}}{nC_6H_{12}O_6}$$

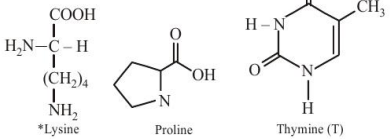
34. **(a)** Tyrosine is a non-essential amino acid.

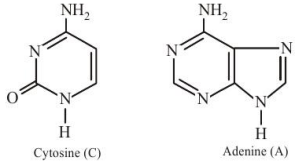
35. **(4)**



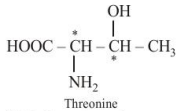
* Represents chiral centre.

36. **(c)** Compounds having 1° amine give carbylamine reaction with $CHCl_3$ and alc. KOH.





37. **(2)**

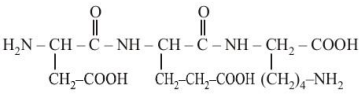


Threonine

No. of chiral centres = 2

38. **5**

Asp – Glu – Lys tripeptide is :



No. of CO group = 5

39. **(37.84)**

Molecular formula of histamine is $C_5H_9N_3$

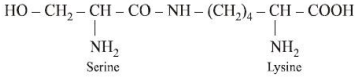
Molecular mass of histamine

$$= 5 \times 12 + 9 \times 1 + 3 \times 14 = 111$$

Mass percentage of nitrogen in histamine

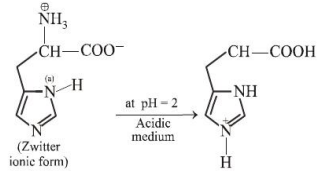
$$= \frac{42}{111} \times 100 = 37.84\%$$

40. **(a)** Ceric ammonium nitrate test is used for detecting alcohols, while carbylamine test is for primary amines. Among the given peptides, only serine (Ser) has alcoholic group.



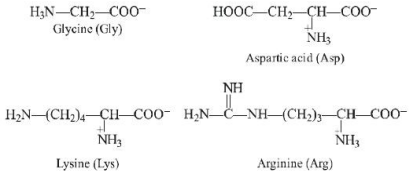
41. **(b)** Lysine

42. **(c)**



Note that *lp* of electrons on N labelled as $N^{(a)}$ are involved in delocalisation, hence not available for protonation.

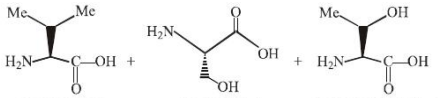
43. **(c)** Structure of the given α-amino acids are:



Here, aspartic acid is acidic, glycine is neutral, while lysine and arginine are basic amino acids. Also, arginine is more basic due to stronger basic functional groups.

$\therefore$ The order of pK_a value is directly proportional to the basic strength of amino acids, thus Arg > Lys > Gly > Asp.

44. (a)



VALINE (Val) SERINE (Ser) THREONINE (Thr)

45. (a) Amino group of glutamine is acetylated while amide group of glutamine is not acetylated.

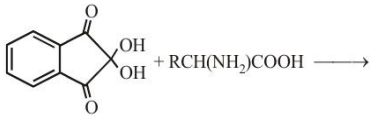
Note :

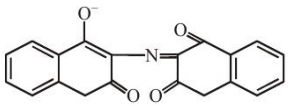
Acetylation of amide requires activation of amides and/or acyl donors, since the nitrogen atom of amides is less basic than that of the corresponding amines due to amide resonance.

46. (b) The N atom of amide is not basic so it will not exist in zwitter ionic form at pH 7.0.

47. (b) Those amino acids that cannot be synthesized in our body and must be supplied in diet is called essential amino acid for ex. valine, histidine, isoluecine etc.

48. (c) Ninhydrin is often used to detect α – amino acids and also free amino and carboxylic acid groups on proteins and peptides. When about 0.5 mL of a 0.1% solution of ninhydrin is boiled for one or two minutes with a few mL of dilute amino acid or protein solution, a blue color develops. Ninhydrin degrades amino acids into aldehydes, ammonia, and CO_2 through a series of reactions

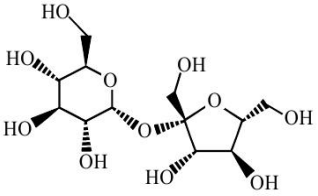


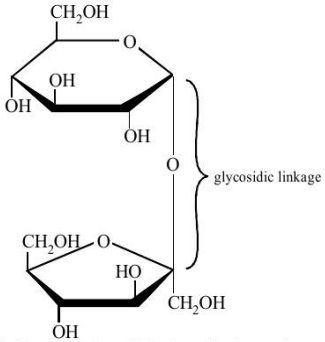


Purple-colored ion

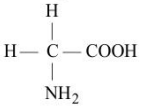
to produce an intensely blue or purple pigment, sometimes called Ruhemann's purple.

49. (b) Glycosidic linkage is actually an ether bond as the linkage forming the rings in an oligosaccharide or polysaccharide is not just one bond, but the two bonds sharing an oxygen atom e.g. sucrose





50. (c) With the exception of glycine all other amino acids have different functional groups (atom) on the central tetrahedral alpha carbon.



Glycine

51. (d) Statement (d) is not correct. Some proteins also contain S, along with C, H, O and N.

52. (b) The secondary structure of a protein refers to the shape in which a long peptide chain can exist. There are two different conformations of the peptide linkage present in protein, these are α-helix and β-conformation. The α-helix always has a right handed arrangement. In β-conformation all peptide chains are streched out to nearly maximum extension and then laid side by side and held together by intermolecular hydrogen bonds. The structure resembles the pleated folds of draping and therefore is known as β-pleated sheet.

53. **(b)** RNA has a single helix structure, whereas, DNA has a double helix structure.

54. **(b)** RNA contains adenine (A), guanine (g), cytosine (c) and uracil (u).

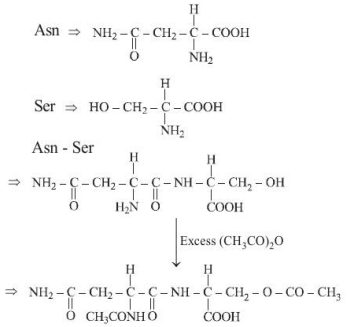
(1) is cytosine, found in RNA and DNA, both.

(2) is uracil, found in RNA only.

(3) is thymine, found in DNA only.

(4) is not a pyrimidine, i.e., nat a constituents of RNA and DNA.

55. **(b)**



56. **(a)**

57. **(a)** Among 20 naturally occuring amino acids "cysteine" has '– SH' or thiol functional group.

⇒ General formula of amino acid

$$H_2N-\underset{\displaystyle R}{\underset{|}{CH}}-COOH$$

⇒ Value of R = $-CH_2-SH$ in cysteine.

58. **(a)** DNA contains ATGC bases

Quinoline is not present in DNA or RNA.

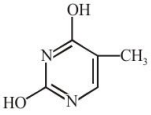
59. **(d)** The two polynucleotide chains of DNA molecules are twisted around a common axis but run in opposite directions to form a right handed helix. The two chains are joined together by specific hydrogen bonds. Adenine-Thymine (two hydrogen bonds) and cytosine-guanine (three hydrogen bonds)

60. **(c)** Butyric acid, also known as butanoic acid is found in milk, and butter and is a product of anaerobic fermentation. It has an unpleasant smell and acrid taste.

61. **(a)** Maltose is obtained by partial hydrolysis of starch by the enzyme diastase present in malt.

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow{\text{Diastase}} nC_6H_{12}O_6 \text{ (maltose)}$$

62. **(d)** The correct structure of thymine is

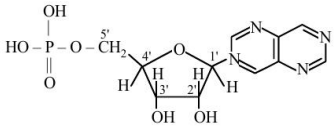


Thymine (T)

63. **(a)**

64. **(a)** The pyrimidine bases present in DNA are cytosine and thymine.

65. **(b)** In DNA and RNA heterocyclic base and phosphate ester are at C_1' and C_5' respectively of the sugar molecule.



66. **(c)** RNA contains cytosine and uracil as pyrimidine bases while DNA has cytosine and thymine.

Both have the same purine bases i.e., guanine and adenine.

67. **(b)** DNA consists of two polynucleotide chains, each chain forms a right handed spiral with ten bases in one turn of the spiral. The two chains coil to double helix and run in opposite direction held together by hydrogen bonding.

68. **(b)** In RNA, the sugar is D–ribose and base is uracil, whereas in DNA, the sugar is D-2 deoxyribose and the nitrogenous base is thymine.

69. **(c)**

Vitamins	Deficiency Diseases
Vitamin B_1 (thiamine)	Beriberi
Vitamin B_2 (riboflavin)	Cheilosis
Vitamin B_6 (pyridoxine)	Convulsions
Vitamin C (ascorbic acid)	Scurvy

70. **(c)** Water soluble vitamins dissolve in water and are not stored by the body. The water soluble vitamins include the vitamin B-complex group and vitamin C.

71. **(c)** Deficiency of vitamin D causes rickets.

72. **(b)** Insulin is a biochemically active peptide hormone secreted by pancreas.