CHAPTER 22

Carbohydrates, Amino Acids, Polymers & Miscellaneous Match the Following

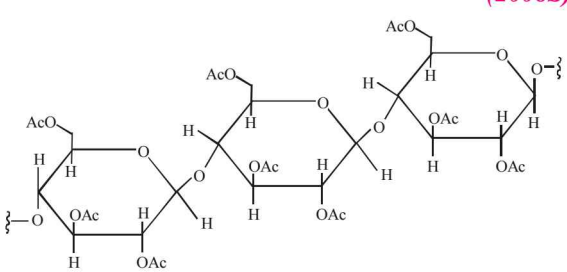
Section-A JEE Advanced/ IIT-JEE

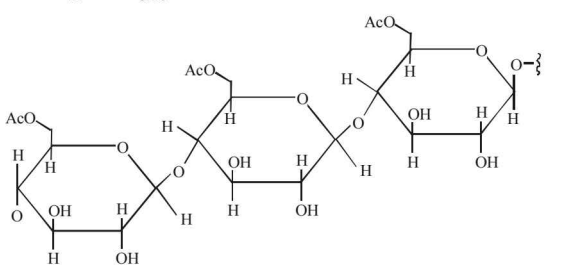
C MCQs with One Correct Answer

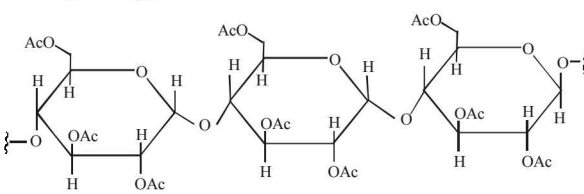
1. The pair of compounds in which both the compounds give positive test with Tollen's reagent is *(2004S)*
   (a) Glucose and Sucrose
   (b) Fructose and Sucrose
   (c) Acetophenone and Hexanal
   (d) Glucose and Fructose

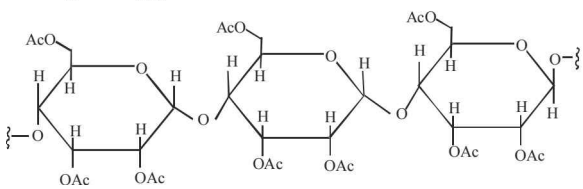
2. The two forms of D–glucopyranose obtained from the solution of D–glucose are called *(2005S)*
   (a) Isomers (b) Anomers
   (c) Epimers (d) Enantiomers

3. Cellulose upon acetylation with excess acetic anhydride/ H_2SO_4 (catalytic) gives cellulose triacetate whose structure is *(2008S)*

(a) 

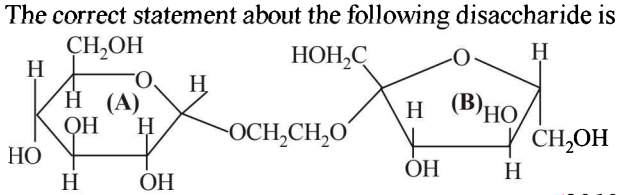
(b) 

(c) 

(d) 

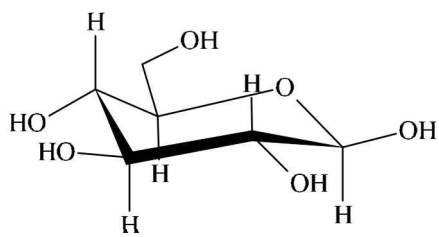
4. Among cellulose, poly (vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is *(2009S)*
   (a) Nylon (b) Poly (vinyl chloride)
   (c) Cellulose (d) Natural Rubber

5. The correct statement about the following disaccharide is



(2010)
   (a) Ring (**A**) is pyranose with α - glycosidic link
   (b) Ring (**A**) is furanose with α - glycosidic link
   (c) Ring (**B**) is furanose with α - glycosidic link
   (d) Ring (**B**) is pyranose with β - glycosidic link

6. The following carbohydrate is *(2011 - II)*

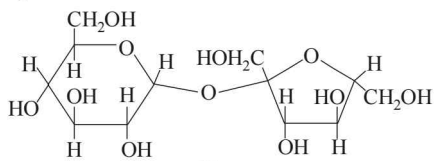


   (a) a ketohexose (b) an aldohexose
   (c) an α-furanose (d) an α-pyranose

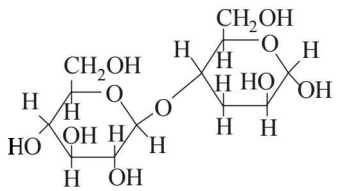
7. On complete hydrogenation, natural rubber produces
   (a) ethylene–propylene copolymer *(JEE Adv. 2016)*
   (b) vulcanised rubber
   (c) polypropylene
   (d) polybutylene

D MCQs with One or More Than One Correct

1. The correct statement(s) about the following sugars **X** and **Y** is(are) *(2009S)*

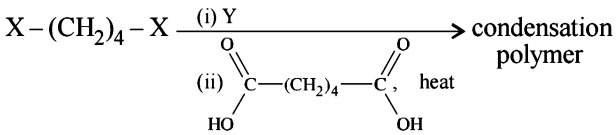


X



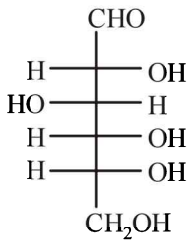
(a) **X** is a reducing sugar and **Y** is a non-reducing sugar
(b) **X** is a non-reducing sugar and **Y** is a reducing sugar
(c) The glucosidic linkages in **X** and **Y** are α and β, respectively
(d) The glucosidic linkages in **X** and **Y** are β and α, respectively

2. The correct functional group X and the reagent/reaction conditions Y in the following scheme are *(2011 - II)*

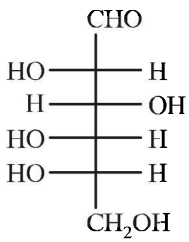
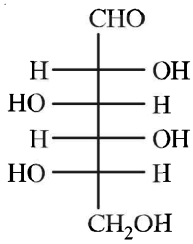
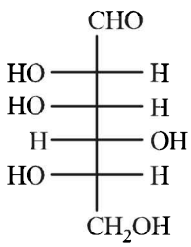
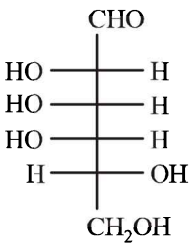


(a) $X = COOCH_3$, $Y = H_2/Ni/heat$
(b) $X = CONH_2$, $Y = H_2/Ni/heat$
(c) $X = CONH_2$, $Y = Br_2/NaOH$
(d) $X = CN$, $Y = H_2/Ni/heat$

3. The structure of D-(+)-glucose is *(JEE Adv. 2015)*



The structure of L-(–)-glucose is

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

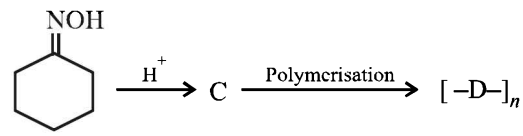
4. For 'invert sugar', the correct statement(s) is(are) (Given : specific rotations of (+) -sucrose, (+)-maltose, L-(-)-glucose and L-(+) fructose in aqueous solution are +66°, +140°, –52° and +92°, respectively) *(JEE Adv. 2016)*

(a) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose
(b) 'invert sugar' is an equimolar mixture of D-(+)-glucose and D-(-)-fructose
(c) specific rotation of 'invert sugar' is –20°
(d) on reaction with Br_2 water, 'invert sugar' forms saccharic acid as one of the products

E Subjective Problems

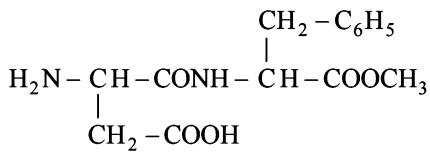
1. Give the structures of the products in each of the following reactions. *(2000 - 4 Marks)*

(i) Sucrose $\xrightarrow{H^+}$ A + B

(ii) 

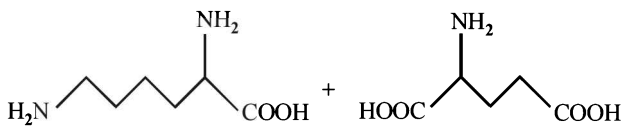
2. Write the structures of alanine at pH = 2 and pH = 10. *(2000 - 2 Marks)*

3. Aspartame, an artificial sweetener, is a peptide and has the following structure : *(2001 - 5 Marks)*

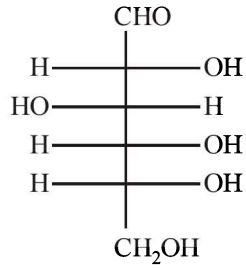


(i) Identify the four functional groups.
(ii) Write the zwitterionic structure.
(iii) Write the structures of the amino acids obtained from the hydrolysis of aspartame.
(iv) Which of the two amino acids is more hydrophobic?

4. Following two amino acids lysine and glutamine form dipeptide linkage. What are two possible dipeptides? *(2003 - 2 Marks)*

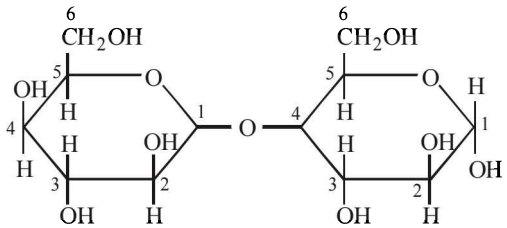


5. The Fisher projection of D-glucose is drawn below. *(2004 - 2 Marks)*

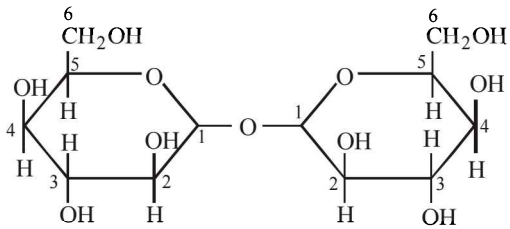


(i) Draw the Fisher projection of L-glucose.
(ii) Give the reaction of L-glucose with Tollen's reagent

6. Which of the following will reduce Tollen's reagent? Explain. *(2005 - 2 Marks)*



A



B

F Match the Following

Each question contains statements given in two columns, which have to be matched. The statements in Column-I are labelled A, B, C and D, while the statements in Column-II are labelled p, q, r, s and t. Any given statement in Column-I can have correct matching with ONE OR MORE statement(s) in Column-II. The appropriate bubbles corresponding to the answers to these questions have to be darkened as illustrated in the following example :
If the correct matches are A-p, s and t; B-q and r; C-p and q; and D-s then the correct darkening of bubbles will look like the given.

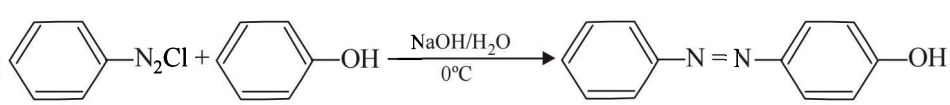
	p	q	r	s	t
A	●	○	○	●	●
B	○	●	●	○	○
C	●	●	○	○	○
D	○	○	○	●	○

1. Match the chemical substances in **Column I** with type of polymers/type of bonds in **Column II**. *(2007)*

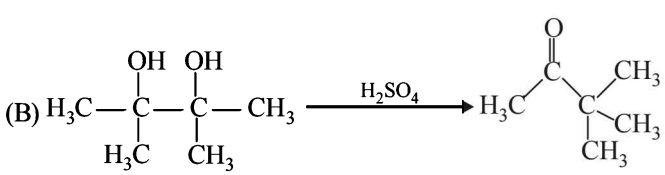
Column I	***Column II***
(A) cellulose	(p) Natural polymer
(B) nylon-6, 6	(q) Synthetic polymer
(C) protein	(r) Amide linkage
(D) sucrose	(s) Glycoside linkage

2. Match the reaction in Column I with appropriate options in Column II. *(2010)*

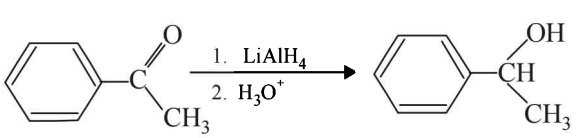
Column-I **Column-II**

(A) 

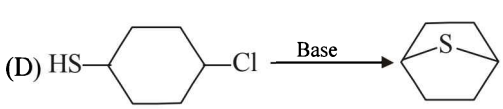
(p) Racemic mixture

(B) 

(q) Addition reaction

(C) 

(r) Substitution reaction

(D) 

(s) Coupling reaction

(t) Carbocation intermediate

H Assertion & Reason Type Questions

1. This question contains Statement-1 (Assertion) and Statement-2 (Reason) and has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

Statement-1 : Glucose gives a reddish-brown precipitate with Fehling's solution.

because

Statement-2 : Reaction of glucose with Fehling's solution give CuO and gluconic acid. *(2007)*

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

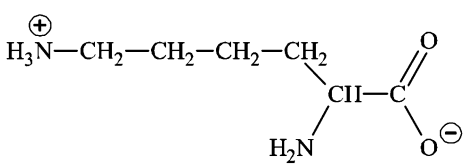
(b) Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1

(c) Statement-1 is True, Statement-2 is False

(d) Statement-1 is False, Statement-2 is True.

I Integer Value Correct Type

1. The total number of basic groups in the following form of lysine is *(2010)*

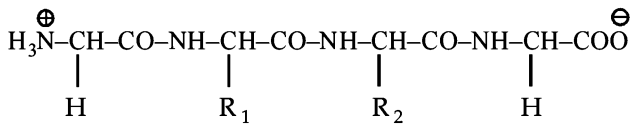


2. A decapeptide (Mol. wt. 796) on complete hydrolysis gives glycine (Mol. wt. 75), alanine and phenylalanine. Glycine contributes 47.0% to the total weight of the hydrolysed products. The number of glycine units present in the decapeptide is *(2011)*

3. When the following aldohexose exists in its D-configuration, the total number of stereoisomers in its pyranose form is : *(2012)*

$CHO-CH_2-CHOH-CHOH-CHOH-CH_2OH$

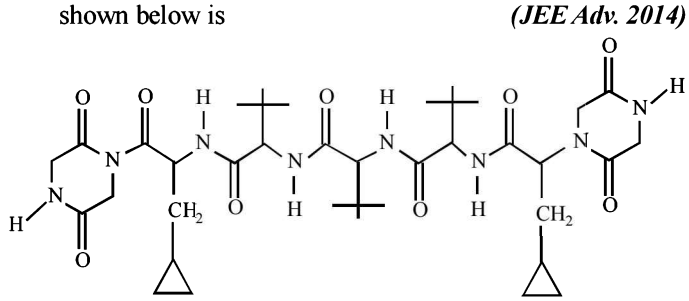
4. The substituents R_1 and R_2 for nine peptides are listed in the table given below. How many of these peptides are positively charged at pH = 7.0 ? *(2012)*



Peptide	R_1	R_2
I	H	H
II	H	CH_3
III	CH_2COOH	H
IV	CH_2CONH_2	$(CH_2)_4NH_2$
V	CH_2CONH_2	CH_2CONH_2
VI	$(CH_2)_4NH_2$	$(CH_2)_4NH_2$
VII	CH_2COOH	CH_2CONH_2
VIII	CH_2OH	$(CH_2)_4NH_2$
IX	$(CH_2)_4NH_2$	CH_3

5. A tetrapeptide has —COOH group on alanine. This produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, the number of possible sequences (primary structures) with —NH_2 group attached to a chiral center is *(JEE Adv. 2013)*

6. The total number of ***distinct naturally occurring amino acids*** obtained by complete acidic hydrolysis of the peptide shown below is *(JEE Adv. 2014)*



Section-B JEE Main / AIEEE

1. Polymer formation from monomers starts by [2002]

(a) condensation reaction between monomers

(b) coordinate reaction between monomers

(c) conversion of monomer to monomer ions by protons

(d) hydrolysis of monomers.

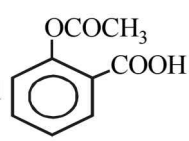
2. RNA is different from DNA because RNA contains [2002]

(a) ribose sugar and thymine

(b) ribose sugar and uracil

(c) deoxyribose sugar and thymine

(d) deoxyribose sugar and uracil.

3. The compound  is used as [2002]

(a) antiseptic (b) antibiotic

(c) analgesic (d) pesticide.

4. Which of the following could act as a propellant for rockets? [2003]

(a) Liquid oxygen + liquid argon

(b) Liquid hydrogen + liquid oxygen

(c) Liquid nitrogen + liquid oxygen

(d) Liquid hydrogen + liquid nitrogen

5. Nylon threads are made of **[2003]**
(a) polyester polymer (b) polyamide polymer
(c) polyethylene polymer (d) polyvinyl polymer

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

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

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

9. 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

10. The smog is essentially caused by the presence of
(a) Oxides of sulphur and nitrogen **[2004]**
(b) O_2 and N_2
(c) O_2 and O_3 (d) O_3 and N_2

11. Which of the following is a polyamide? **[2005]**
(a) Bakelite (b) Terylene
(c) Nylon-66 (d) Teflon

12. Which one of the following types of drugs reduces fever ?
(a) Tranquiliser (b) Antibiotic **[2005]**
(c) Antipyretic (d) Analgesic

13. In both DNA and RNA, heterocylic 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

14. Which of the following is fully fluorinated polymer? **[2005]**
(a) PVC (b) Thiokol
(c) Teflon (d) Neoprene

15. 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

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

17. 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.

18. Identify the wrong statement in the following: **[2008]**
(a) Chlorofluorocarbons are responsible for ozone layer depletion
(b) Greenhouse effect is responsible for global warming
(c) Ozone layer does not permit infrared radiation from the sun to reach the earth
(d) Acid rain is mostly because of oxides of nitrogen and sulphur

19. Bakelite is obtained from phenol by reacting with
(a) $(CH_2OH)_2$ (b) CH_3CHO **[2008]**
(c) CH_3COCH_3 (d) HCHO

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

21. Among the following substituted silanes the one which will give rise to cross linked silicone polymer on hydrolysis is
(a) R_4Si (b) RSiCl **[2008]**
(c) R_2SiCl_2 (d) R_3SiCl

22. Buna-N synthetic rubber is a copolymer of : **[2009]**
(a) $H_2C=CH-CH=CH_2$ and $H_5C_6-CH=CH_2$
(b) $H_2C=CH-CN$ and $H_2C=CH-CHCH_2$
(c) $H_2C=CH-CN$ and $H_2C=CH-\underset{\underset{CH_3}{|}}{C}=CH_2$
(d) $H_2C=CH-\underset{\underset{Cl}{|}}{C}=CH_2$ and $H_2C=CH-CH=CH_2$

23. 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

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

25. The polymer containing strong intermolecular forces e.g. hydrogen bonding, is **[2010]**
(a) teflon (b) nylon 6, 6
(c) polystyrene (d) natural rubber

26. The presence or absence of hydroxyl group on which carbon atom of sugar differentiates RNA and DNA? **[2011]**

(a) 1^{st} (b) 2^{nd}

(c) 3^{rd} (d) 4^{th}

27. Which of the following compounds can be detected by Molisch's Test? **[2012]**

(a) Nitro compounds (b) Sugars

(c) Amines (d) Primary alcohols

28. The species which can best serve as an initiator for the cationic polymerization is : **[2012]**

(a) $LiAlH_4$ (b) HNO_3

(c) $AlCl_3$ (d) BaLi

29. 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

30. Aspirin is known as : **[2012]**

(a) Acetyl salicylic acid (b) Phenyl salicylate

(c) Acetyl salicylate (d) Methyl salicylic acid

31. Synthesis of each molecule of glucose in photosynthesis involves : **[JEE M 2013]**

(a) 18 molecules of ATP (b) 10 molecules of ATP

(c) 8 molecules of ATP (d) 6 molecules of ATP

32. Which one is classified as a condensation polymer? **[JEE M 2014]**

(a) Dacron (b) Neoprene

(c) Teflon (d) Acrylonitrile

33. Which one of the following bases is **not** present in DNA? **[JEE M 2014]**

(a) Quinoline (b) Adenine

(c) Cytosine (d) Thymine

34. Which of the vitamins given below is water soluble ? **[JEE M 2015]**

(a) Vitamin E (b) Vitamin K

(c) Vitamin C (d) Vitamin D

35. Which of the following compounds is not an antacid ? **[JEE M 2015]**

(a) Phenelzine (b) Ranitidine

(c) Aluminium hydroxide (d) Cimetidine

36. Which polymer is used in the manufacture of paints and lacquers ? **[JEE M 2015]**

(a) Polypropene (b) Polyvinyl chloride

(c) Bakelite (d) Glyptal

37. The concentration of fluoride, lead, nitrate and iron in a water sample from an underground lake was found to be 1000 ppb, 40 ppb, 100 ppm and 0.2 ppm, respectively. This water is unsuitable for drinking due to high concentration of : **[JEE M 2016]**

(a) Nitrate (b) Iron

(c) Fluoride (d) Lead

38. Which of the following is an anionic detergent? **[JEE M 2016]**

(a) Cetyltrimethyl ammonium bromide.

(b) Glyceryl oleate.

(c) Sodium stearate.

(d) Sodium lauryl sulphate.

39. Which of the following statements about low density polythene is **FALSE**? **[JEE M 2016]**

(a) Its synthesis requires dioxygen or a peroxide initiator as a catalyst.

(b) It is used in the manufacture of buckets, dust-bins etc.

(c) Its synthesis requires high pressure.

(d) It is a poor conductor of electricity.

Miscellaneous – Match The Following For IIT-JEE

I. Each item from (i) to (x) given below indicates a reaction type, a process or a homologue. Match each of these items with the related phrase by writing the correct phrase in the corresponding vacant space given under each. The correct phrase must be picked only from those given below within brackets :

(*Baeyer's process, Nucleophilic addition, Free radical substitution, Ostwald's process, Homologous pair, Cyanamide process, Electrophilic substitution, Homolytic addition, Thermite process, Nucleophilic substitution*)

(1981 - 1× 10 = 10 Marks)

(*i*) Cyclopropane, chlorine and light
.....

(*ii*) Welding
.....

(*iii*) Propanone and sodium bisulphite
.....

(*iv*) Production of ammonia
.....

(*v*) Chloromethane and methanol
.....

(*vi*) Ore purification
.....

(*vii*) Ethanal and methanal
.....

(*viii*) Benzene, nitric acid and sulphuric acid
.....

(*ix*) Production of nitric acid
.....

(*x*) Propene, hydrogen bromide and a peroxide catalyst
.....

II. Match the following, choosing one item from column X and one from column Y. An example is — for item No. (i) – (g)

(1982 - 3 Marks)

A.

	X	Y
(*i*)	Hg_2Cl_2	(a) cassiterite
(*ii*)	$(NaPO_3)_n$	(b) lunar caustic
(*iii*)	NO_3^-	(c) producer gas
(*iv*)	SnO_2	(d) water softener
(*v*)	$KCl.MgCl_2.6H_2O$	(e) brown ring test
(*vi*)	$AgNO_3$	(f) carnallite
(*vii*)	$CO + N_2$	(g) calomel

B. ***(1982 - 3 Marks)***

(*viii*)	pyrolysis of alkanes	(j) elimination reaction
(*ix*)	benzene+chloroethane (+anhydrous $AlCl_3$)	(k) saponification
(*x*)	$CH_3COOC_2H_5$ + NaOH	(l) Wurtz reaction
(*xi*)	preparation of alkanes	(m) Friedel-Crafts reaction
(*xii*)	phenol + $CHCl_3$ (NaOH)	(n) Reimer-Tiemann reaction
(*xiii*)	C_2H_5Br + alc. KOH	(o) cracking

C. ***(1982 - 2 Marks)***

(*xiv*)	neutrons	(p) Kohlrausch
(*xv*)	molecular speed	(q) Vander Waals
(*xvi*)	intermolecular forces	(r) Maxwell
(*xvii*)	conductance of ions	(s) Chadwick

D. ***(1982 - 2 Marks)***

(*xviii*)	mass spectrum	(t) wave function
(*xix*)	x-ray spectrum	(u) unpaired electrons
(*xx*)	paramagnetism	(v) atomic number
(*xxi*)	orbitals	(w) isotopes

III. Match the following, choosing one item from column X and the appropriate item from column Y. Write down the matched pair on the answescript : ***(1983 - 2 Marks)***

A.

(*i*)	Decarboxylation	(a) Addition reaction
(*ii*)	Ozonolysis	(b) Soda lime
(*iii*)	Williamson's synthesis	(c) Structure of alkene
(*iv*)	Dichloroethylene	(d) Ether

B. ***(1983 - 2 Marks)***

(*i*)	Luca's test	(a) Phenol
(*ii*)	Netural $FeCl_3$ test	(b) Glucose
(*iii*)	Dye test	(c) Tertiary alcohol
(*iv*)	Tollen's test	(d) Aniline

C. ***(1983 - 2 Marks)***

	X	Y
(*i*)	Al	(a) Calamine
(*ii*)	Cu	(b) Cryolite
(*iii*)	Mg	(c) Malachite
(*iv*)	Zn	(d) Carnallite

D. ***(1983 - 2 Marks)***

(*i*)	Haber	(a) Activation energy
(*ii*)	Graham	(b) Diffusion of gases
(*iii*)	Arrhenius	(c) Octet rule
(*iv*)	Lewis	(d) Ammonia synthesis

IV. Write the matched set (of three) for each entry in column A:

(1984 - 1 × 5 = Mark)

	A	B	C
(i)	Asbestos	(a) molecular sieve	(1) air pollutant
(ii)	Fluorocarbons	(b) paramagnetic	(2) carcinogen
(iii)	Lithium metal	(c) refrigeration	(3) fluorscent paint
(iv)	Nitric oxide	(d) reducing agent	(4) electron donor
(v)	Zeolites	(e) semi-conductor	(5) ion exchanger
(vi)	Zinc oxide	(f) silicates of (Ca + Mg)	(6) propellent

V. Match each item of the right hand column with an appropriate item in the left hand column for each of the following sections:

(1985 - 2½ × 4 = 10 Marks)

A.	(*i*)	spinel	(a)	$MgAl_2O_4$
	(*ii*)	feldspar	(b)	PbCO
	(*iii*)	cerussite	(c)	$KAlSi_3O_8$
	(*iv*)	malachite	(d)	$MgSO_4.H_2O$
	(*v*)	kisserite	(e)	$Cu(OH)_2.CuCO_3$
B.	(*vi*)	liquid air	(f)	Deacon process
	(*vii*)	Na_2CO_3	(g)	Parke process
	(*viii*)	nitric oxide	(h)	Claude process
	(*ix*)	silver	(i)	Ostwald process
	(*x*)	chlorine	(j)	Solvay process
C.	(*xi*)	phenol	(k)	coloured glass
	(*xii*)	$Na_2S_2O_3$	(l)	antichlor
	(*xiii*)	salicyclic acid	(m)	refractory material
	(*xiv*)	quick lime	(n)	antiseptic
	(*xv*)	CuO	(o)	analgesic
D.	(*xvi*)	Aston	(p)	radium
	(*xvii*)	Priestley	(q)	radioactivity
	(*xviii*)	Ramsay	(r)	oxygen
	(*xix*)	Marie Curie	(s)	inert gas
	(*xx*)	Bacquerel	(t)	mass spectrum

VI. Match the following choosing one item from column X and the appropriate item from column Y: ***(1986 - ½×8 = 4 Marks)***

	X		**Y**
(*i*)	Lewis acid	(a)	K electron capture
(*ii*)	Philosopher's wool	(b)	Zinc ore
(*iii*)	Electrophile	(c)	HCHO
(*iv*)	Preservative	(d)	NH_4^+
(*v*)	Electron emission	(e)	Small proton to neutron ratio
(*vi*)	Bronsted acid	(f)	SO_3
(*vii*)	Black jack	(g)	BF_3
(*viii*)	X-ray emission	(h)	ZnO

VII. Each entry in column X is in some way related to the entries in column Y and Z. Match the appropriate entries. ***(1988 - 1 × 10 = 10 Marks)***

(*i*)	**X**	**Y**	**Z**
	Animal charcol	$kJ\ deg^{-1}$	watch spring
	Invar	cm^{-1}	1.3805×10^{-26}
	Nichrome	Co, Ni	sugar refining
	Rydberg	Fe, Ni	cutlery
	Stainless steel	Fe, Cr, Ni, C	109677
	Boltzmann	C, $Ca_3(PO_4)_2$	heating element

(*ii*)	**X**	**Y**	**Z**
	Friedel-Crafts	Oil	Alkenes
	Fermentation	Lewis acid	Soap
	Dehydrohalogenation	Cuprous Chloride	Anhydrous $AlCl_3$
	Sandmeyer	Yeast	Chlorobenzene
	Saponification	Alcoholic alkali	Ethanol

VIII. Each entry in column X is in some way related to the entries in column Y and Z. Match the appropriate entries : ***(1989 - 5 × 1 = 5 Marks)***

X	**Y**	**Z**
A.Mica	(a) Graphite crystallite	(i) Abrasive
B. Superphosphate	(b) Cubic	(ii) Insulator
C. Carbon fibres	(c) Layer structure	(iii) Fertilizer
D. Rock salt	(d) Diamond structure	(iv) Reinforced plastics
E. Carborundum	(e) Bone ash	(v) Preservative

Example : **Yeast Fermentation Ethanol**

IX. All the compounds listed in Column I react with water. Match the result of the respective reactions with the appropriate options listed in Column II. ***(2010)***

Column-I		**Column-II**	
(A)	$(CH_3)_2SiCl_2$	(p)	Hydrogen halide formation
(B)	XeF_4	(q)	Redox reaction
(C)	Cl_2	(r)	Reacts with glass
(D)	VCl_5	(s)	Polymerization
		(t)	O_2 formation

22 Carbohydrates, Amino Acids, Polymers & Miscellaneous Match the Following

Section-A : JEE Advanced/ IIT-JEE

C **1.** (d) **2.** (b) **3.** (a) **4.** (d) **5.** (a) **6.** (b) **7.** (a)

D **1.** (b, c) **2.** (a, b, c, d) **3.** (a) **4.** (b, c)

E **3.** (i) Amine, Carboxylic acid, Amide, Ester

[*For answers of rest of the questions refer solutions*]

F **1.** (A) - p,s ; (B) - q,r ; (C) - p,r ; (D) - s **2.** (A) - r,s ; (B) - t ; (C) - p,q ; (D) - r **3.** (A) - p,s ; (B) - p,q,r,t ; (C) - p, q; (D) - p,q

H **1.** (c)

I **1.** 2 **2.** 6 **3.** 8 **4.** 4 **5.** 4 **6.** 1

Section-B : JEE Main/ AIEEE

1.	(a)	**2.**	(b)	**3.**	(c)	**4.**	(b)	**5.**	(b)	**6.**	(b)	**7.**	(b)	**8.**	(c)
9.	(b)	**10.**	(a)	**11.**	(c)	**12.**	(c)	**13.**	(b)	**14.**	(c)	**15.**	(b)	**16.**	(a)
17.	(b)	**18.**	(c)	**19.**	(d)	**20.**	(c)	**21.**	(c)	**22.**	(b)	**23.**	(c)	**24.**	(a)
25.	(b)	**26.**	(b)	**27.**	(b)	**28.**	(c)	**29.**	(c)	**30.**	(a)	**31.**	(a)	**32.**	(a)
33.	(a)	**34.**	(c)	**35.**	(a)	**36.**	(d)	**37.**	(a)	**38.**	(d)	**39.**	(b)		

Section-A JEE Advanced/ IIT-JEE

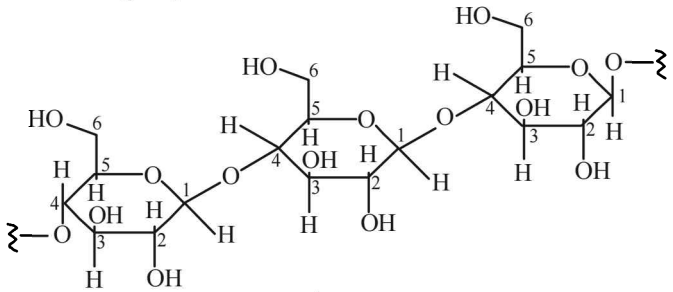
C. MCQs with ONE Correct Answer

1. **(d)** Glucose being an aldose responds to Tollen's test while fructose, although a ketose, undergoes rearrangement in presence of basic medium (provided by Tollen's reagent) to form glucose, which then responds to Tollen's test.

2. **(b)** The two isomeric forms (a – and b –) of D-glucopyronose differ in configuration only at C–1; hence these are called anomers.

3. **(a)** Cellulose is a polysaccharide composed of only D-glucose units. Every adjacent glucose units are joined by β-glycosidic linkage between C_1 of one glucose and C_4 of the next.

NOTE : Thus in every glucose units only three –OH groups are free to form triacetate.

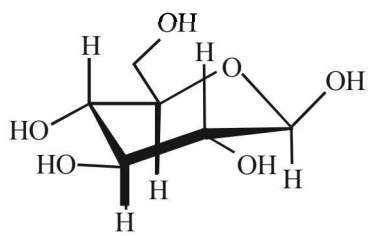


Cellulose triacetate $\xrightarrow{(CH_3CO)_2O,\ H_2SOI_4}$ $(-OH = -OCOCH_3)$

4. **(d)** Nylon and cellulose, both have intermolecular hydrogen bonding, polyvinyl chloride has dipole-dipole interaction, while natural rubber has van der Waal forces which are weakest.

5. **(a)**

6. **(b)**



It is a β-pyranose hence it is an aldohexose.

7. **(a)**

$$CH_2 = \underset{\text{Isoprene}}{\overset{CH_3}{\overset{|}{C}} - CH = CH_2} \xrightarrow{\text{Polymerisation}} \underset{\text{Natural rubber}}{\{CH_2 - \overset{CH_3}{\overset{|}{C}} = CH - CH_2\}}$$

$\xrightarrow[\text{catalyst}]{H_2(\text{excess})}$

$$\underset{\text{Ethylene}}{CH_2 = CH_2} + \underset{\text{Propylene}}{CH_2 = \overset{CH_3}{\overset{|}{CH}}} \xrightarrow{\text{Copolymerisation}} \underset{\text{Completely hydrogenated Natural rubber}}{\{CH_2 - \overset{CH_3}{\overset{|}{CH}} - CH_2 - CH_2\}}$$

D. MCQs with ONE or More Than One Correct

1. **(b,c)** We know that carbohydrates having acetal linkage are non-reducing while that with hemiacetal linkage are reducing. In the give structure,

X has acetal linkage, hence non-reducing.
Y has hemiacetal linkage, hence reducing.
Further **X** is α-anomer, while **Y** is β-anomer of D-(+)-glucose.

2. (a,b,c,d)

Condensation polymers are formed by condensation of a diol or diamine with a dicarboxylic acid.

Hence, X may be $-\overset{O}{\overset{\|}{C}}-OR$ or $-\overset{O}{\overset{\|}{C}}-NH_2$ or $-C\equiv N$

$$H_3CO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OCH_3 \xrightarrow{H_2/Ni} OHH_2C-(CH_2)_4-CH_2OH$$

$$\xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyester}$$

$$H_2N-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-NH_2 \xrightarrow{H_2/Ni} H_2NCH_2-(CH_2)_4-CH_2NH_2$$

$$\xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyamide}$$

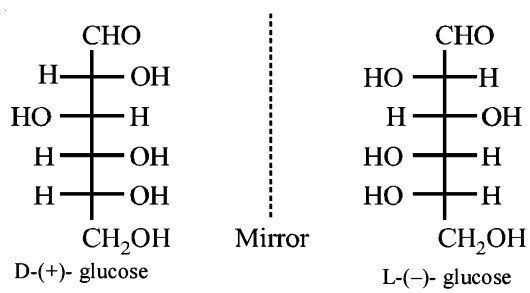
$Br_2/OH^-, \Delta$
Hofmann bromamide reaction

$$H_2N-(CH_2)_4-NH_2 \xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyamide}$$

$$N\equiv C-(CH_2)_4-C\equiv N \xrightarrow{H_2/Ni} H_2NCH_2-(CH_2)_4-CH_2NH_2$$

$$\xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyamide}$$

3. (a)



4. (b, c)

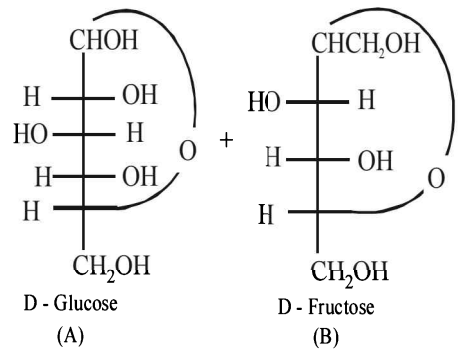
Invert sugar is an equimolar mixture of D-(+) glucose and D(–) glucose.

$$\underset{\text{+ sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underbrace{\underset{\substack{\text{D(+)–glucose}\\(+52°)}}{C_6H_{12}O_6} + H_2O \xrightarrow{+} \underset{\substack{\text{D(+)–glucose}\\(-92°)}}{C_6H_{12}O_6}}_{\text{Invert sugar}}$$

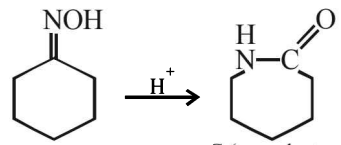
- Specific rotation of invert sugar $= \dfrac{-92°+52°}{2} = -20°$
- D-glucose on oxidation with Br_2-water produces gluconic acid and not saccharic acid.

E. Subjective Problems

1. (i) Sucrose ⟶



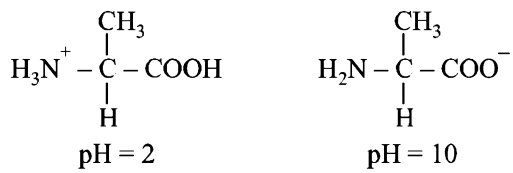
(ii)



$\longrightarrow [-CO-NH-\{CH_2\}_5-]_n$
Nylon

2. TIPS/Formulae :

pH = 2 indicates acidic character whereas pH = 10 indicates basic character.



3.

$$H_2N-\underset{\displaystyle CH_2-COOH}{\overset{\displaystyle CH_2-C_6H_5}{CH}}-CONH-CH-COOCH_3$$

Aspartame (Aspartamine)

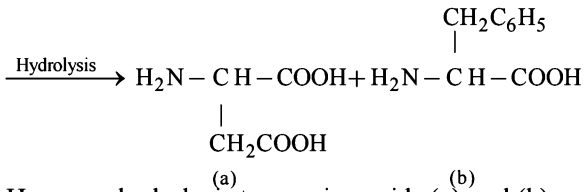
(i) Four functional groups present in aspartamine are
(a) $-NH_2$ (Amine)
(b) –COOH (Carboxylic acid)
(c) $-\overset{O}{\overset{\|}{C}}-NH-$ (Amide)
(d) $-\overset{O}{\overset{\|}{C}}-O-CH_3$ (Ester)

(ii) Zwitterion structure is given as follows :

$$H_3\overset{+}{N}-\underset{\displaystyle CH_2-COO^-}{\overset{\displaystyle CH_2C_6H_5}{CH}}-CONH-CH-COOCH_3$$

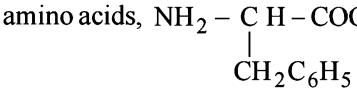
(iii)

$$H_2N-\underset{\displaystyle CH_2COOH}{CH}-\overset{O}{\overset{\|}{C}}-NH-\overset{CH_2C_6H_5}{\overset{|}{CH}}-COOCH_3$$

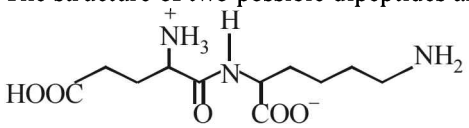


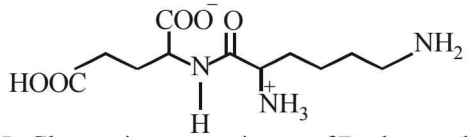
(a) (b)

Hence on hydrolysis two amino acids (a) and (b) are obtained.

(iv) Of the above two amino acids,  is more hydrophobic due to presence of non-polar and bulky benzyl group.

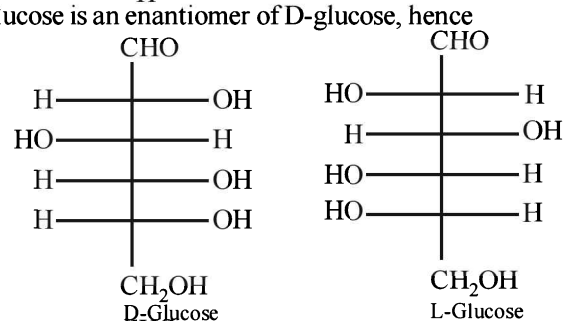
4. The structure of two possible dipeptides are





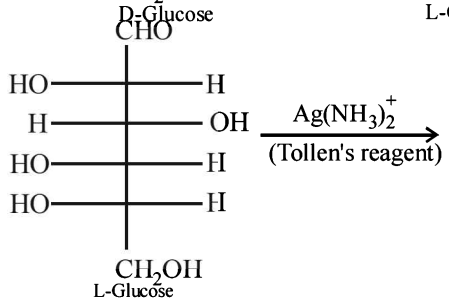
5. L-Glucose is an enantiomer of D-glucose, hence

(i)

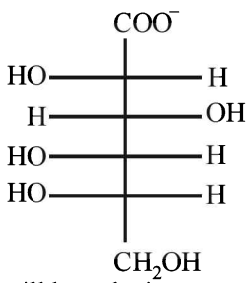


D-Glucose L-Glucose

(ii)



L-Glucose



6. In the two disaccharides structure A will be reducing sugar since both monosaccharides units are not linked through their reducing centers, while in structure B both the monosaccharide units are linked through their reducing centers, hence it will be non-reducing.

F. Match the Following

1.

(A) : (p) an d(s)		Cellulose is a natural polymer and has a $C_1 - C_4$ β-glycosidic linkage.
(B) : (q) and (r)		Nylon-6, 6 is a synthetic polymer of hexamethylenediamine and adipic acid and has amide linkages.
(C) : (p) and (r)		Proteins are natural polymers of α amino acids joined by amide linkages (peptide bonds).
(D) : (s)		Sucrose is a disaccharide of α-D glucose and β-D-fructose and has an α, β-glycosidic linkage.

2. (A) – (r), (s) ; (B) – (t) ; (C) – (p), (q) ; (D) – (r)

H. Assertion & Reason Type Questions

1. **(c)** Statement-1 is correct, but statement-2 is incorrect because glucose on reaction with Fehling solution gives Cu_2O and not CuO.

I. Integer Value Correct Type

1. The basic groups in the given form of lysine is NH_2 (not $\overset{\oplus}{N}H_3$) and CO_2^-.

2. **6**

Molecular weight of decapeptide = 796 g/mol

Total bonds to be hydrolysed = (10 – 1) = 9 per molecule

Total weight of H_2O added = 9 × 18 = 162 g/mol

Total weight of hydrolysis products = 796 + 162 = 958 g

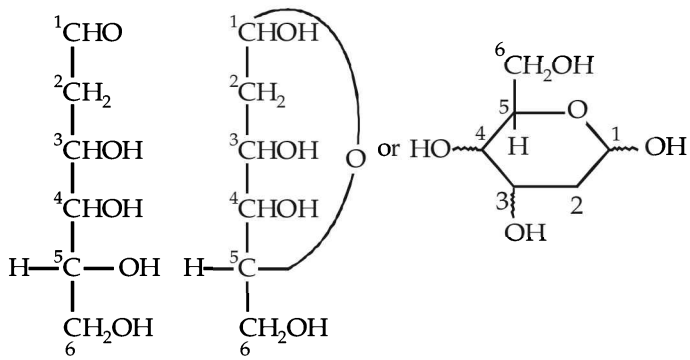
Total weight % of glycine (given) = 47%

$$\text{Total weight of glycine in product} = \frac{958 \times 47}{100}\text{g} = 450\text{g}$$

Molecular weight of glycine = 75 g/mol

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

3. **(8)**



D- Aldohexose D- Aldohexopyranose

Thus, total number of stereoisomers in pyranose form of D-configuration = $2^3 = 8$

4. **(4)** Peptides with isoelectric point (pI) more than 7, would exist as cation in neutral solution (pH = 7) which means the given polypeptide is of basic nature, so it must contain two or more amino groups. Hence IV, VI, VIII and IX are correct options.

5. **(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

6. **(1)** On hydrolysis, the given peptide gives only one naturally occurring amino acid (glycine).

Section-B JEE Main/ AIEEE

1. **(a)** Polymerisation starts either by condensation or addition reactions between monomers. Condensation polymers are formed by the combination of monomers with the elimination of simple molecules. Where as the addition polymers are formed by the addition together of the molecules of the monomer or monomers to form a large molecule without elimination of any thing.

2. **(b)** In RNA, the sugar is D–ribose and base is uracil where as in DNA, the sugar is D-2 de oxyribose and the nitrogenous base is thymine.

3. **(c)** The given compound is aspirin which is antipyretic and analgesic

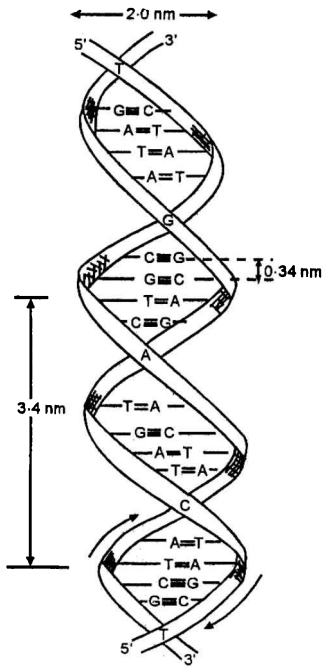
4. **(b)** Liquid hydrogen and liquid oxygen are used as excellent fuel for rockets. $H_2(\ell)$ has low mass and high enthalpy of combustion whereas oxygen is a strong supporter of combustion.

5. **(b)** Nylon is a polyamide polmer.

6. **(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 does undergo hydrolysis to give only D– glucose.

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

7. **(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.



8. **(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.

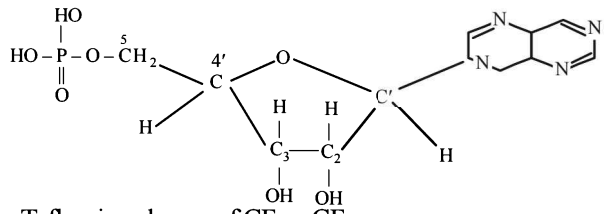
9. **(b)** Insulin is a biochemically active peptide harmone secreted by pancreas.

10. **(a)** Photochemical smog is caused by oxides of sulphur and nitrogen.

11. **(c)** Nylon is a general name for all synthetic fibres forming polyamides.

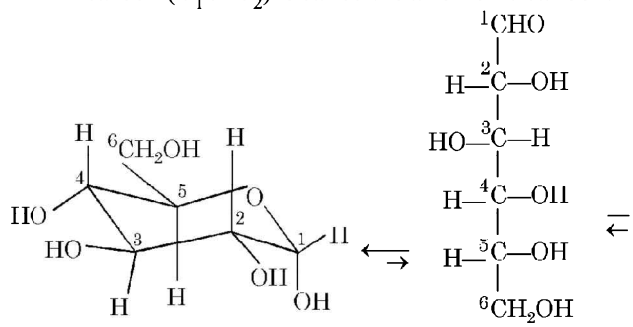
12. **(c)** An antipyretic is a drug which is responsible for lowering the temperature of the feverish organism to normal but has no effect on normal temperature states.

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



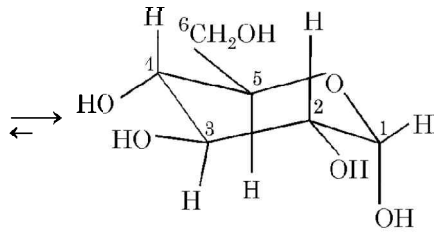
14. **(c)** Teflon is polymer of $CF_2 = CF_2$.

15. (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.**



α–D-(+)-Glucopyranose
m.p. 146°C ; $[\alpha]_D$ = + 112.2°
(36% at equilibrium)

Open chain form
of D-(+)-glucose
(negligible % at equbilibrium)



β–D-(+)-Glucopyranose
m.p. 150°C ; $[\alpha]_D$ = + 18.7°
(64% at equilibrium)

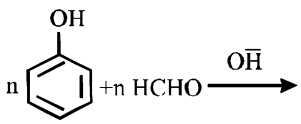
m)

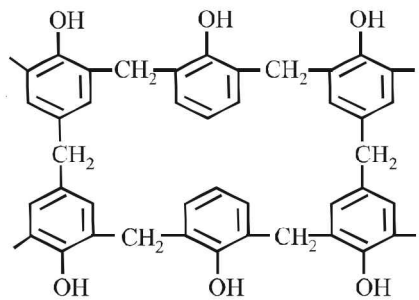
16. (a) The pyrimidine bases present in DNA are cytosine and thymine.

17. (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 drapery and therefore is known as β-pleated sheet.

18. (c) **NOTE :** Ozone layer acts as a shield and does not allow ultraviolet radiation from sun to reach earth. It does not prevent infra-red radiation from sun to reach earth.
Thus option (c) is wrong statement and so it is the correct answer.

19. (d) Bakelite is formed by the reaction of formaldehyde (HCHO) and phenol so the correct answer is (d).

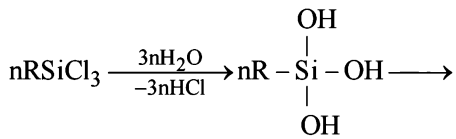


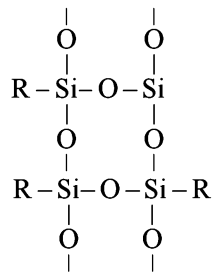


Bakelite

20. (c) Since α – D – (+) – glucose and β – D – (+) glucose differ in configuration at C – 1 atom so they are anomers.
NOTE : Anomers are those diastereomers that differ in configuration at C – 1 atom.
i.e., (c) in the correct answer.

21. (c) The cross linked polymers will be formed by $RSiCl_3$





(Cross linked polymer)

The correct choice is (c)

22. (b) Buna – N is a copolymer of butadiene ($CH_2=CH-CH=CH_2$) and acrylonitrile ($CH_2=CHCN$).

23. (c) **NOTE :** Glucose is considered as a typical carbohydrate which contains –CHO and –OH group.

24. (a) Biuret test produces violet colour on addition of dilute $CaSO_4$ to alkaline solution of a compound containing peptide linkage.

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

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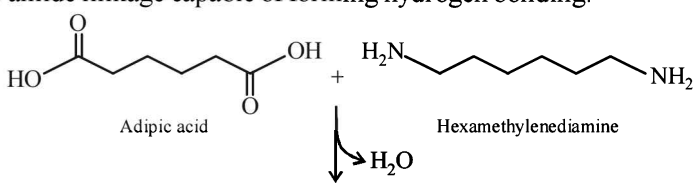
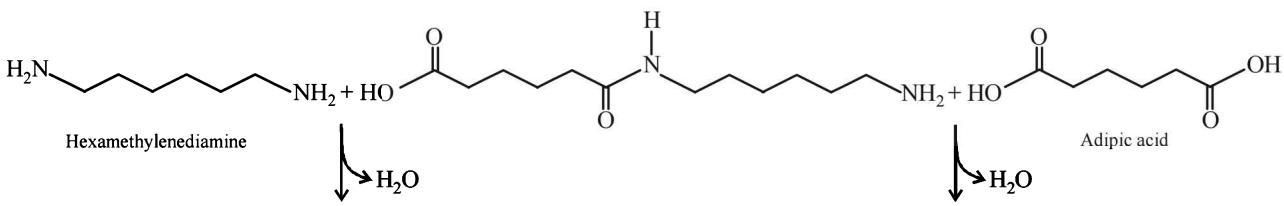
25. (b) Nylon 6-6 has amide linkage capable of forming hydrogen bonding.

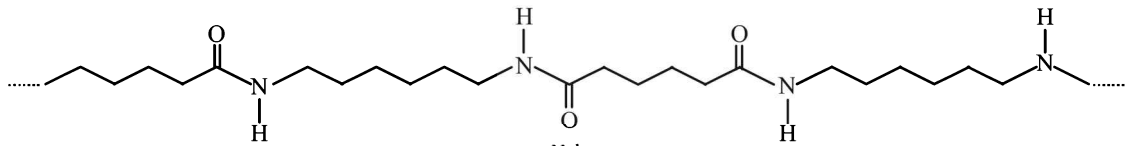


Adipic acid Hexamethylenediamine



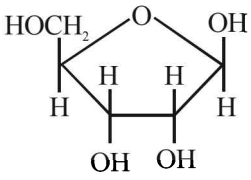
Hexamethylenediamine Adipic acid

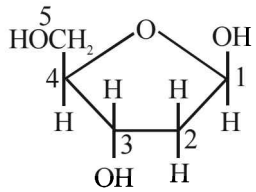
Polymerization



Nylon

26. (b) RNA has D (–) - Ribose and the DNA has 2–Deoxy D (–) – ribose as the carbohydrate unit.


ribose

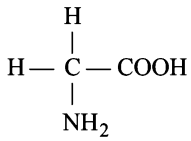

2-deoxy ribose

From the structures it is clear that 2nd carbon in DNA do not have OH group.

27. (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.

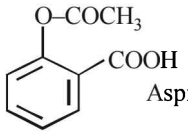
28. (c) Lewis acids are the most common compounds used for initiation of cationic polymerisation. The more popular Lewis acids are $SnCl_4$, $AlCl_3$, BF_3 and $TiCl_4$.

29. (c) With the exception of glycine all the 19 other common amino acids have a uniquely different functional group on the central tetrahedral alpha carbon.



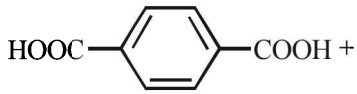
glycine

30. (a)


Aspirin (Acetyl salicylic acid)

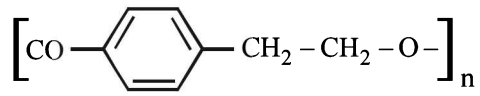
31. (a) $6CO_2 + 12NADPH + 18ATP \rightarrow C_6H_{12}O_6 + 12NADP + 18ADP$

32. (a) Except Dacron all are additive polymers. Terephthalic acid condenses with ethylene glycol to give Dacron.


Terephthalic acid

$HO-CH_2-CH_2-OH \longrightarrow$

Ethylene glycol


Dacron (Polyester)

33. (a) DNA contains ATGC bases

So quinoline is not present in DNA.

34. (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.

35. (a) Phenelzine is an antidepressant, while others are antacids.

36. (d) Glyptal is used in the manufacture of paints and lacquers.

37. (a) The maximum limit of nitrate in drinking water is 50 ppm. Excess nitrate in drinking water can cause disease such as methemoglobinemia ('blue baby' syndrome).

38. (d) Sodium lauryl sulphate ($C_{11}H_{23}CH_2OSO_3^-Na^+$) is an anionic detergent. Glyceryl oleate is a glyceryl ester of oleic acid. Sodium stearate ($C_{17}H_{35}COO^-Na^+$) is a soap. Cetyltrimethyl ammonium bromide

$\left[CH_3(CH_2)_{15}\overset{+}{N}(CH_3)_3\right]Br^-$ is a cationic detergent.

39. (b) High density polythene is used in the manufacture of housewares like buckets, dustbins, bottles, pipes etc. Low density polythene is used for insulating electric wires and in the manufacture of flexible pipes, toys, coats, bottles etc.

MISCELLANEOUS — MATCH THE FOLLOWING FOR IIT-JEE

I. (*i*) Free radical substitution (*ii*) Thermite process
(*iii*) Nucleophilic addition (*iv*) Cyanamide process;
(*v*) Nucleophilic subsitution (*vi*) Baeyer's process
(*vii*) Homologous pair
(*viii*) Electrophilic substitution (*ix*) Ostwald's process
(*x*) Homolytic addition.

II. A. (*i*) (g) (*ii*) (d) (*iii*) (e) (*iv*) (a)
(*v*) (f) (*vi*) (b) (*vii*) (c)
B. (*viii*) (o) (*ix*) (m) (*x*) (k) (*xi*) (*l*)
(*xii*) (n) (*xiii*) (j)
C. (*xiv*) (s) (*xv*) (r) (*xvi*) (q) (*xvii*) (p)
D. (*xviii*) (w) (*xix*) (v) (*xx*) (u) (*xxi*) (t).

III. A. (*i*) (b) (*ii*) (c) (*iii*) (d) (*iv*) (a)
B. (*i*) (c) (*ii*) (a) (*iii*) (d) (*iv*) (b)
C. (*i*) (b) (*ii*) (c) (*iii*) (d) (*iv*) (a)
D. (*i*) (d) (*ii*) (b) (*iii*) (a) (*iv*) (c).

IV. (*i*)-(f)-6; (*ii*)-(c)-2; (*iii*)-(d)-4; (*iv*)-(b)-1; (*v*)-(a)-5; (*vi*)-(e)-3.

V. A. (*i*) (a) (*ii*) (c) (*iii*) (b) (*iv*) (e) (*v*) (d)
B. (*vi*) (h) (*vii*) (j) (*viii*) (i) (*ix*) (g) (*x*) (f)
C. (*xi*) (n) (*xii*) (l) (*xiii*) (o) (*xiv*) (m) (*xv*) (k)
D. (*xvi*) (t) (*xvii*) (r) (*xviii*) (s) (*xix*) (p) (*xx*) (q)

VI. (*i*) (g) (*ii*) (h) (*iii*) (f) (*iv*) (c)
(*v*) (e) (*vi*) (d) (*vii*) (b) (*viii*) (a)

VII. (*i*) Invar/Fe, Ni/watch spring; Nichrome/Co, Ni/heating element; Rydberg/cm^{-1}/109677; Stainless steel/Fe, Cr, Ni, C/cutlery; Boltzmann/kJ deg^{-1}/1.3805×10^{-26}

(*ii*) Friedel-Craft/Lewis acid/anhydrous $AlCl_3$; Fermentation/yeast/ethanol; Dehydrogenation/ alcoholic alkali/alkene; Sandmeyer/cuprous chloride/ chlorobenzene; Saponification/oil/soap.

VIII. A-(c)-(ii); B-(e)-(iii); C-(a)-(iv); D-(b)-(v); E-(d)-(i).

IX. **(A) – (p), (s)** $(CH_3)_2SiCl_2 + 2H_2O \xrightarrow[-2HCl]{} (CH_3)_2Si(OH)_2 \xrightarrow{\text{Polymerisation}} [(CH_3)_2Si{-}O]_n$

(B) – (p), (q), (r), (t) $XeF_4 + H_2O \longrightarrow Xe + XeO_3 + H_2F_2 + O_2$

$SiO_2 + 4HF \longrightarrow SiF_4 + 2H_2O$
glass

$SiF_4 + 2HF \longrightarrow H_2[SiF_6]$
Soluble hexathorosilicic(IV) acid

(C) – (p), (q) $Cl_2 + H_2O \longrightarrow HCl + HOCl$

(D) – (p), (q) $VCl_5 + 7H_2O \longrightarrow [V(H_2O)_6]^{3+} + 3Cl^- + HCl + HOCl$