

CHAPTER 22

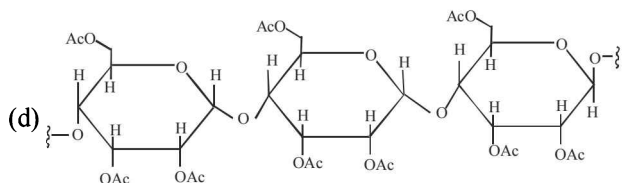
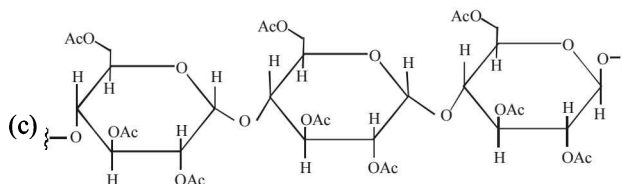
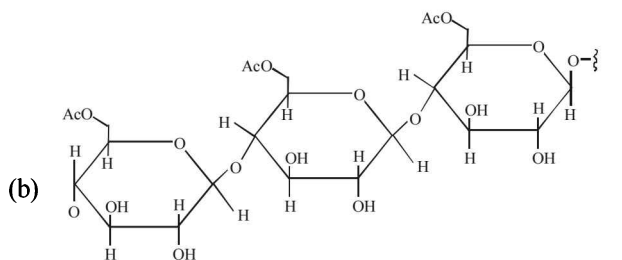
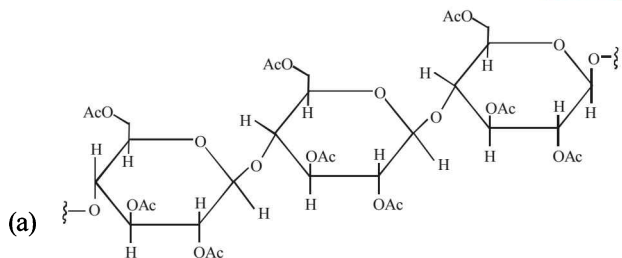
Carbohydrates, Amino Acids, Polymers & Miscellaneous Match the Following

Section-A

JEE Advanced/ IIT-JEE

C MCQs with One Correct Answer

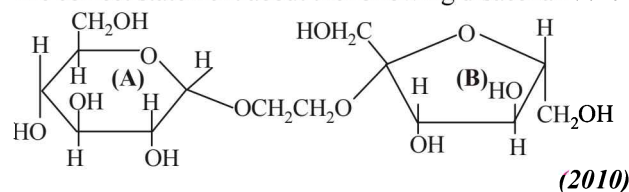
- The pair of compounds in which both the compounds give positive test with Tollen's reagent is (2004S)
 - Glucose and Sucrose
 - Fructose and Sucrose
 - Acetophenone and Hexanal
 - Glucose and Fructose
- The two forms of D-glucopyranose obtained from the solution of D-glucose are called (2005S)
 - Isomers
 - Anomers
 - Epimers
 - Enantiomers
- Cellulose upon acetylation with excess acetic anhydride/ H_2SO_4 (catalytic) gives cellulose triacetate whose structure is (2008S)



- Among cellulose, poly (vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is (2009S)

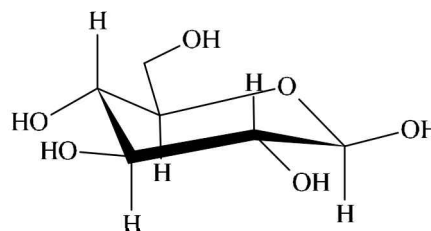
- Nylon
- Poly (vinyl chloride)
- Cellulose
- Natural Rubber

- The correct statement about the following disaccharide is



- Ring (A) is pyranose with α - glycosidic link
- Ring (A) is furanose with α - glycosidic link
- Ring (B) is furanose with α - glycosidic link
- Ring (B) is pyranose with β - glycosidic link

- The following carbohydrate is (2011-II)

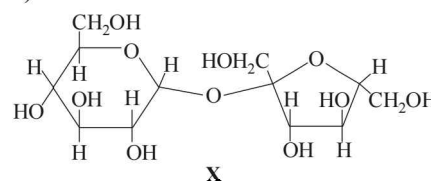


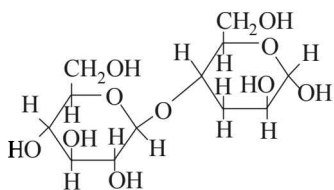
- a ketohexose
- an aldohexose
- an α -furanose
- an α -pyranose

- On complete hydrogenation, natural rubber produces
 - ethylene-propylene copolymer (JEE Adv. 2016)
 - vulcanised rubber
 - polypropylene
 - polybutylene

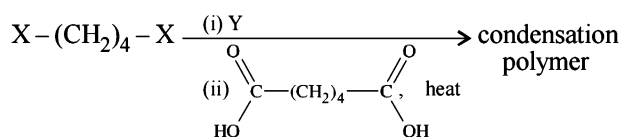
D MCQs with One or More Than One Correct

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

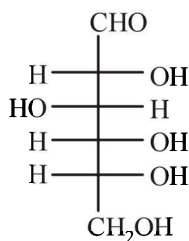




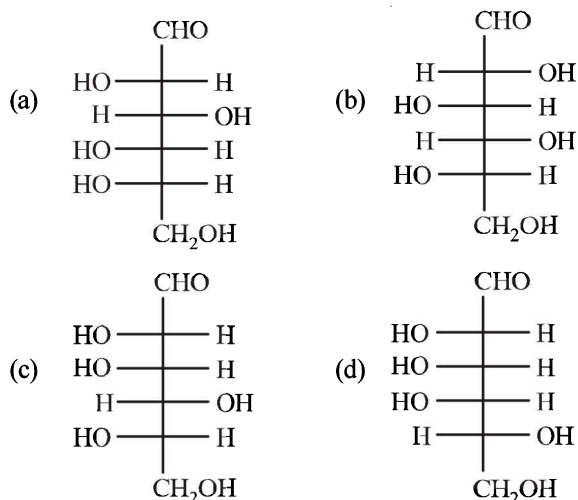
- (a) X is a reducing sugar and Y is a non-reducing sugar
 (b) X is a non-reducing sugar and Y is a reducing sugar
 (c) The glucosidic linkages in X and Y are α and β , respectively
 (d) The glucosidic linkages in X and Y are β and α , respectively
2. The correct functional group X and the reagent/reaction conditions Y in the following scheme are (2011 - II)



- (a) $X = \text{COOCH}_3$, $Y = \text{H}_2/\text{Ni}/\text{heat}$
 (b) $X = \text{CONH}_2$, $Y = \text{H}_2/\text{Ni}/\text{heat}$
 (c) $X = \text{CONH}_2$, $Y = \text{Br}_2/\text{NaOH}$
 (d) $X = \text{CN}$, $Y = \text{H}_2/\text{Ni}/\text{heat}$
3. The structure of D-(+)-glucose is (JEE Adv. 2015)



The structure of L-(-)-glucose is

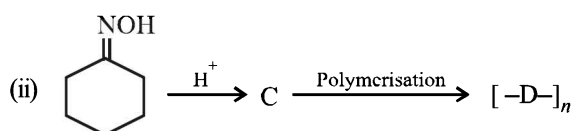
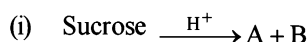


4. For 'invert sugar', the correct statement(s) is(are)
 (Given : specific rotations of (+) -sucrose, (+)-maltose, L-(-)-glucose and L-(+) fructose in aqueous solution are $+66^\circ$, $+140^\circ$, -52° and $+92^\circ$, respectively) (JEE Adv. 2016)
- (a) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose

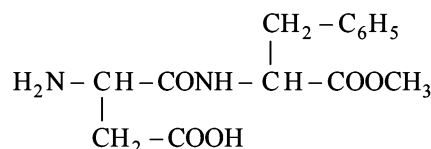
- (b) 'invert sugar' is an equimolar mixture of D-(+)-glucose and D-(-)-fructose
 (c) specific rotation of 'invert sugar' is -20°
 (d) on reaction with Br_2 water, 'invert sugar' forms saccharic acid as one of the products

E Subjective Problems

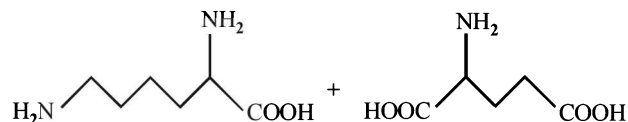
1. Give the structures of the products in each of the following reactions. (2000 - 4 Marks)



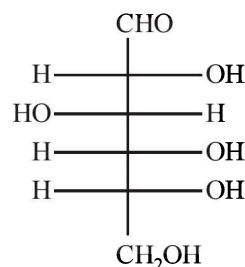
2. Write the structures of alanine at pH = 2 and pH = 10. (2000 - 2 Marks)
3. Aspartame, an artificial sweetener, is a peptide and has the following structure : (2001 - 5 Marks)



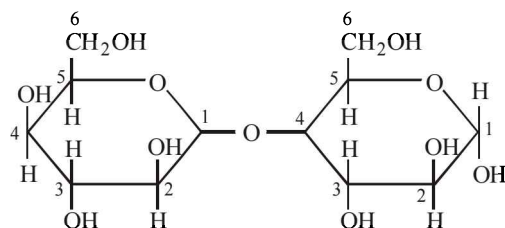
- (i) Identify the four functional groups.
 (ii) Write the zwitterionic structure.
 (iii) Write the structures of the amino acids obtained from the hydrolysis of aspartame.
 (iv) Which of the two amino acids is more hydrophobic?
4. Following two amino acids lysine and glutamine form dipeptide linkage. What are two possible dipeptides? (2003 - 2 Marks)



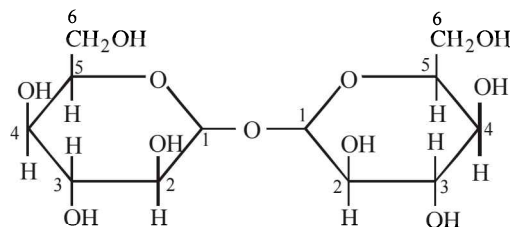
5. The Fisher projection of D-glucose is drawn below. (2004 - 2 Marks)



- (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	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
B	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
C	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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

(2007)

Column I

- (A) cellulose
(B) nylon-6, 6
(C) protein
(D) sucrose

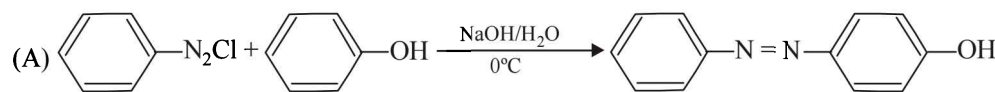
Column II

- (p) Natural polymer
(q) Synthetic polymer
(r) Amide linkage
(s) Glycoside linkage

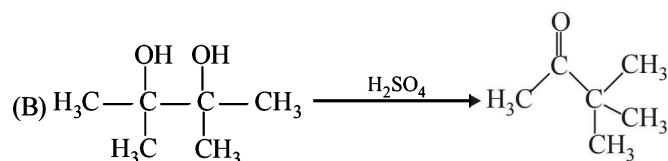
2. Match the reaction in Column I with appropriate options in Column II.

(2010)

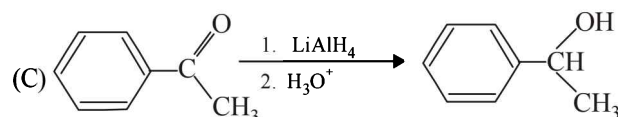
Column-I



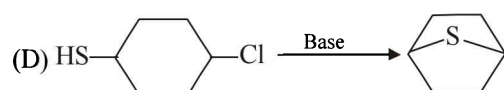
(p) Racemic mixture



(q) Addition reaction



(r) Substitution reaction



(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.

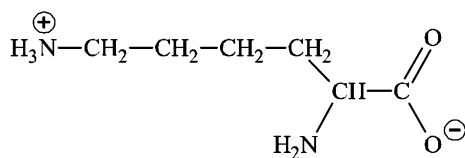
because

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

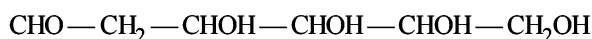
- (a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (b) Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1
 (c) Statement-1 is True, Statement-2 is False
 (d) Statement-1 is False, Statement-2 is True.

I Integer Value Correct Type

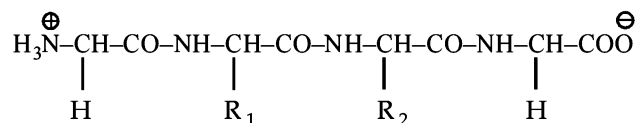
1. The total number of basic groups in the following form of lysine is (2010)



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)

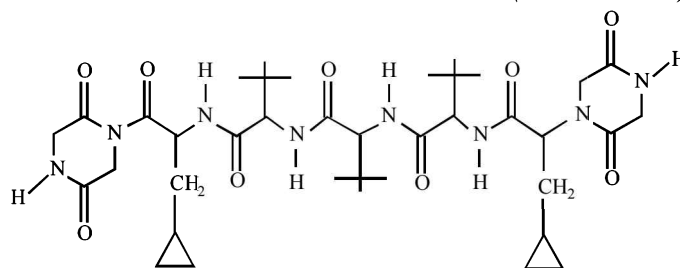


4. The substituents R_1 and R_2 for nine peptides are listed in the table given below. How many of these peptides are positively charged at pH = 7.0 ? (2012)



Peptide	R_1	R_2
I	H	H
II	H	CH_3
III	CH_2COOH	H
IV	CH_2CONH_2	$(\text{CH}_2)_4\text{NH}_2$
V	CH_2CONH_2	CH_2CONH_2
VI	$(\text{CH}_2)_4\text{NH}_2$	$(\text{CH}_2)_4\text{NH}_2$
VII	CH_2COOH	CH_2CONH_2
VIII	CH_2OH	$(\text{CH}_2)_4\text{NH}_2$
IX	$(\text{CH}_2)_4\text{NH}_2$	CH_3

5. A tetrapeptide has $-\text{COOH}$ group on alanine. This produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, the number of possible sequences (primary structures) with $-\text{NH}_2$ 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

Carbohydrates, Amino Acids, Polymers & Miscellaneous Match the Following

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 ? [2004]
 - (a) Guanine (b) Cytosine
 - (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 [2004]
 - (a) Oxides of sulphur and nitrogen
 - (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 ? [2005]
 - (a) Tranquiliser (b) Antibiotic
 - (c) Antipyretic (d) Analgesic
13. 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
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 [2008]
 - (a) $(CH_2OH)_2$ (b) CH_3CHO
 - (c) CH_3COCH_3 (d) $HCHO$
20. α - D-(+)-glucose and β -D-(+)-glucose are [2008]
 - (a) conformers (b) epimers
 - (c) anomers (d) enantiomers
21. Among the following substituted silanes the one which will give rise to cross linked silicone polymer on hydrolysis is [2008]
 - (a) R_4Si (b) $RSiCl$
 - (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 $H_2C=CH-\underset{\substack{| \\ CH_3}}{C}=CH_2$
 - (d) $H_2C=CH-\underset{\substack{| \\ Cl}}{C}=CH_2$ 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) 1st (b) 2nd
(c) 3rd (d) 4th
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 - $1 \times 10 = 10$ 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)

	X	Y
A.	(i) Hg_2Cl_2	(a) cassiterite
	(ii) $(\text{NaPO}_3)_n$	(b) lunar caustic
	(iii) NO_3^-	(c) producer gas
	(iv) SnO_2	(d) water softener
	(v) $\text{KCl.MgCl}_2.6\text{H}_2\text{O}$	(e) brown ring test
	(vi) AgNO_3	(f) carnallite
	(vii) $\text{CO} + \text{N}_2$	(g) calomel

B. (1982 - 3 Marks)

- (viii) pyrolysis of alkanes (j) elimination reaction
 (ix) benzene+chloroethane (+anhydrous AlCl_3) (k) saponification
 (x) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH}$ (l) Wurtz reaction

- (xi) preparation of alkanes (m) Friedel-Crafts reaction
 (xii) phenol + CHCl_3 (NaOH) (n) Reimer-Tiemann reaction
 (xiii) $\text{C}_2\text{H}_5\text{Br} + \text{alc. KOH}$ (o) cracking
 (1982 - 2 Marks)

C.

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

D.

- (xviii) mass spectrum (t) wave function
 (xix) x-ray spectrum (u) unpaired electrons
 (xx) paramagnetism (v) atomic number
 (xxi) orbitals (w) isotopes
 (1982 - 2 Marks)

- III** Match the following, choosing one item from column X and the appropriate item from column Y. Write down the matched pair on the answer script : (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.

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

C.

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

D.

- (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 - $1 \times 5 = 5$ Marks)

A	B	C
(i) Asbestos	(a) molecular sieve	(1) air pollutant
(ii) Fluorocarbons	(b) paramagnetic	(2) carcinogen
(iii) Lithium metal	(c) refrigeration	(3) fluorescent 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) propellant

- 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 - $2\frac{1}{2} \times 4 = 10$ Marks)

- A.** (i) spinel (a) MgAl_2O_4
 (ii) feldspar (b) PbCO_3
 (iii) cerussite (c) KAlSi_3O_8
 (iv) malachite (d) $\text{MgSO}_4 \cdot \text{H}_2\text{O}$
 (v) kisserite (e) $\text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$
- 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) $\text{Na}_2\text{S}_2\text{O}_3$ (l) antichlor
 (xiii) salicylic 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) Becquerel (t) mass spectrum

VI. Match the following choosing one item from column X and the appropriate item from column Y: $(1986 - \frac{1}{2} \times 8 = 4 \text{ Marks})$

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.

$(1988 - 1 \times 10 = 10 \text{ Marks})$

(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, $\text{Ca}_3(\text{PO}_4)_2$	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 :

$(1989 - 5 \times 1 = 5 \text{ Marks})$

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) $(\text{CH}_3)_2\text{SiCl}_2$	(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