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UNIT-10 SURFACE CHEMISTRY

STUDY MATERIAL

Unit – 10 Surface Chemistry

Book inside one mark

1.Which of the following process does not occur at the interface of phases?
(i) crystallisation (ii) heterogenous catalysis
(iii) homogeneous catalysis (iv) corrosion
Explanation: In homogeneous catalysis, only, the reactant and product are in same phase and composition is uniform throughout

2.At the equilibrium position in the process of adsorption _____.
(i) $\Delta H > 0$ **(ii) $\Delta H = T\Delta S$** (iii) $\Delta H > T\Delta S$ (iv) $\Delta H < T\Delta S$
Explanation: At equilibrium $\Delta G=0$ $\Delta G=\Delta H-T\Delta S$

3.Extent of physisorption of a gas increases with _____.
(i) increase in temperature.
(ii) decrease in temperature.
(iii) decrease in surface area of adsorbent.
(iv) decrease in strength of van der Waals forces.
Explanation: Since the adsorption (Solid+ Gas=Gas/Solid+ Heat) process is exothermic, the physical adsorption occurs readily at low temperature and decreases with increasing temperature as the equilibrium will shift in backward direction. (Le-Chatelier's principle).

4.Which one of the following is not applicable to the phenomenon of adsorption?
(i) $\Delta H > 0$ (ii) $\Delta G < 0$ (iii) $\Delta S < 0$ (iv) $\Delta H < 0$
Explanation: Since adsorption is an exothermic process ΔH cannot be greater than zero.

5.Which of the following is not a favourable condition for physical adsorption?
(i) high pressure (ii) negative ΔH
(iii) higher critical temperature of adsorbate **(iv) high temperature**
Explanation: High temperature is not favourable for physical adsorption since it is an exothermic process.

6.Physical adsorption of a gaseous species may change to chemical adsorption with
(i) decrease in temperature
(ii) increase in temperature
(iii) increase in surface area of adsorbent
(iv) decrease in surface area of adsorbent
Explanation: On increasing the temperature activation energy of the adsorbate molecule increases. Which can convert physical adsorption into chemisorptions.

7. In physisorption adsorbent does not show specificity for any particular gas because_____.
(i) involved van der Waals forces are universal
(ii) gases involved behave like ideal gases.
(iii) enthalpy of adsorption is low.
(iv) it is a reversible process.

8. Gelatin is mostly used in making ice cream in order to
a) prevent making of colloid.
b) to stabilize the colloid and to prevent the crystallization.

c) to stabilize the mixture.
d) to enrich the aroma.
9. Bleeding is stopped by the application of ferric chloride. This is because _____.
a) ferric chloride seal the blood cells.
b) blood starts flowing in other direction.
c) blood is coagulated and blood vessels is sealed.
d) blood is peptised.
10. Adsorption is always _____.
a) endothermic **b) exothermic** c) Iso thermic d) either a (or) b
11. According to the adsorption theory of catalysis, the speed of the reaction increases because
a)Adsorption produces heat which increases the speed of the reaction.
b)Adsorption lowers the activation energy of the reaction
c)The concentration of reactant molecules at the active centres of the catalyst becomes high due to adsorption.
d)In the process of adsorption, the activation energy of the molecules become large.
12.Freshly prepared precipitate sometimes gets converted to colloidal solution by ____.
(i) coagulation (ii) electrolysis (iii) diffusion ` **(iv) peptisation**
Explanation: Peptisation is the process in which freshly prepared precipitate can be converted into colloidal solution.
13.Which of the following process is responsible for the formation of delta at a place where rivers meet the sea?
(i) Emulsification (ii) Colloid formation **(iii) Coagulation** (iv) Peptisation
14.Which of the following process is not responsible for the presence of electric charge on the sol particles?
(i)Electron capture by sol particles. ii) Adsorption of ionic species from solution.
(iii) Formation of Helmholtz electrical double layer
(iv) Absorption of ionic species from solution.
Explanation: The charge on the sol particles is due to one or more reasons, Viz.,
(a) due to electron capture by sol particles during electrodispersion of metals,
(b) due to preferential adsorption of ions from solution and/or
(c) due to formulation of electrical double layer.
15.Which of the following statements are correct?
(i) Mixing two oppositely charged sols neutralises their charges and stabilises the colloid.
(ii) Presence of equal and similar charges on colloidal particles provides stability to the colloids.
(iii) Any amount of dispersed liquid can be added to emulsion without destabilising it.
(iv) Brownian movement stabilises sols.
16.Which of the following substances will precipitate the negatively charged emulsions?
(i) KCl (ii) glucose (iii) urea **(iv) NaCl**
Explanation: Negatively charged emulsion can be precipitated by oppositely charged electrolyte. Na^+ and K^+ from the electrolyte can neutralize the negatively charge emulsion and precipitate the colloid.

17.What happens when a lyophilic sol is added to a lyophobic sol?
(i) Lyophobic sol is protected.
(ii) Lyophilic sol is protected.
(iii) Film of lyophilic sol is formed over lyophobic sol.
(iv) Film of lyophobic sol is formed over lyophilic sol.

18.Which of the following phenomenon occurs when a chalk stick is dipped in ink?
(i) adsorption of coloured substance (ii) adsorption of solvent
(iii) absorption and adsorption both of solvent **(iv) absorption of solvent**
Ans. (i) and (iv)
Explanation: When a chalk stick is dipped in ink, the surface retains the colour of the ink due to adsorption of coloured When a chalk stick is dipped in ink, the surface retains the colour of the ink due to adsorption of coloured molecules while the solvent of the ink goes deeper into the stick due to absorption.

19. Which among the following does not affect adsorption?
a) surface area of the adsorbent **b) catalyst**
c) temperature d) pressure

20. According to Freundlich adsorption isotherm,
a) xm = kp b) mx = $(kp)^{1/n}$ **c)** xm **= $kp^{1/n}$** d) xm = kp1n

21. Which of the following is true regarding Freundlich adsorption isotherm equation?
a) Purely empirical
b) Valid only over a limited pressure range.
c) The value of constants k and n varies with temperature
d) All the above

22. Adsorption is accompanied by
a) decrease in free energy b) increase in free energy
c) increase in entropy d) both (b) and (c)

23. Which of the following interface cannot be obtained?
a) solid – solid b) solid – liquid **c) gas – gas** d) liquid – liquid

24. Auto catalysis is observed in the reaction given b elow.
$CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_5OH$
Identify the auto catalyst.
a) $CH_3COOC_2H_5$ b) H_2O **c) CH_3COOH** d) C_2H_5OH

25. Which among the following reactions is an example of auto catalysis?
i) $CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_5OH$
ii) $2H_2O_2 \quad 2H_2O + O_2$
iii) $2SO_2 + O_2 \quad 2SO_3$
iv) $2AsH_3 \quad 2As + 3H_2$
a) only (i) b) (i) and (ii) c) (i) and (iii) **d) (i) and (iv)**

26. Fog is a colloidal solution of
a) gas in liquid b) liquid in gas c) gas in solid **d) solid in gas**

27. The intermediate compound formation theory does not explain
a) action of catalytic poison

b) specificity of a catalyst
c) the mechanism of heterogeneous catalysed reaction
d) both (a) and (c)

28. Colloidal solution of ink is prepared by
a) mechanical dispersion b) electro dispersion
c) ultrasonic dispersion d) peptisation

29. The migration of colloidal particles under the influence of an electric field is known as
a) electro – osmosis **b) cataphoresis** c) electrodialysis d) dialysis

30. The phenomenon of Tyndall's effect is not observed in _____.
a) emulsion b) colloidal solution **c) true solution** d) none

31. For selective hydrogenation of alkynes into alkene the catalyst used is _____.
a) Ni at 250˚C b) Pt at 25˚C
c) Pd, partially inactive by guinoline d) Raney nickel

32. Emulsion can be broken into constituent liquids by _____
a) heating b) freezing c) centrifuging **d) all the above**

32.Which among the following is found to be solvent loving in nature?
a) Lyophilic b) Lyophobic c) Gel d) Sol

33. A substance that enhances the catalytic activity of the catalyst is_____
a) gel b) sol **c) promoter** d) poison

34. Peptisation is not used to prepare
a) silver chloride sol b) ferric hydroxide so c) both (a) and (b) **d) colloidal platinum**

35. The combination of two layers of charges around the sol particle is called
a) Brownian movement b) Tyndall effect **c) Helmholtz double layer** d) None of these

36. The decomposition of hydrogen peroxide in the presence of colloidal platinum is a/an
a) positive catalysis b) negative catalysis c) auto – catalysis d) induced catalysis

37. The iron catalyst used in the synthesis of ammonia in Haber's process is poisoned by
a) As_2O_3 b) V_2O_5 **c) H_2S** d) Glycerine

38. Haze is a colloidal solution of
a) gas in liquid b) liquid in gas c) gas in solid **d) solid in gas**

39. Emulsifying agent used for O/W type emulsion is:
a) proteins b) heavy metal salts of fatty acids
c) long chain alcohol d) lamp black

40. In the decomposition of hydrogen peroxide _____ acts a negative catalyst.
a) H_2S **b) glycerol** c) pt d) Fe

41. Brownian movement of colloidal particles is a _____ property.
a) Kinetic b) Electrical c) Optical d) Magnetic

42.The process of separation of emulsion into two separate layers is called _____.
a) Emulsification **b) Deemulsification** c) Coagulation d) Flocculation

43. The process of hardening of leather is called _____.
a) coagulation **b) tanning** c) centrifuging d) stabilization

44. The platinum catalyst used in the oxidation of SO_2 by contact process is poisoned by
a) As_2O_3 b) V_2O_5 c) Fe_2O_3 d) $CuCl_2$

45. The process of sorption of gases on metal surface is called _____.
a) Desorption b) Dissolution **c) Occlusion** d) Condensation

46. The catalyst and promoter used in Haber's process are respectively _____.
a) Mo, Fe b) Fe, Mo c) Pt, H_2S d) Pt, V_2O_5

47. In the reaction $2H_2 + O_2$ $2H_2O$ acts as a catalytic poison for Pt catalyst.
a) Co b) Mo c) As_2O_3 d) H_2S

48. Which of the following act as catalyst in the oxidation of alcohol into acetic acid?
a) pepsin b) diastase **c) micoderma** d) urease

49. Enzymes can be active in human body at a temperature of _____.
a) 98˚F b) 105˚F c) 37˚F d) 50˚F

49. The migration of sol particles under the influence of electric field is called _____.
a) electro osmosis b) electro dialysis **c) electrophoresis** d) dialysis

50. Which of the following colloid is used as a medicine for stomach troubles?
a) colloidal Au b) colloidal Ca **c) milk of magnesia** d) silver sol

51.Which of the following is used in tanning of leather?
a) chromium salt b) colloidal Au c) Argyrol d) $Fe(OH)_3$

52. Which one of the following is used to distinguish Natural honey and artificial honey?
a) Ammonical $AgNO_3$ b) Fehling's solution c) Arsenic sulphide sol d) gelatin

53. Gold number gives _____.
a) the amount of gold present in the colloid
b) the amount of gold required to break the colloid.
c) the amount of gold required to protect the colloid.
d) the measure of protective power of a lyophilic colloid.

54. The place where rivers meet the sea is the delta region. Which of the following?
a) Emulsification b) Peptisation c) Gel formation **d) Coagulation**

Short Answers(Book Back)

1.Give two importance characteristics of physisorption.

(i) It is reversible.
(ii)It has low heat of adsorption.
(iii)It has weak van der Waals forces of attraction with adsorbent.
(iv)It increase with increases in pressure.
(v)It forms multimolecular layer.

2.Differentiate physisorption and chemisorption.

Chemical adsorption or Chemisorption	Physical adsorption or Physisorption
1. It is very slow	1. It is instantaneous
2. It is very specific depends on nature of adsorbent and adsorbate.	2. It is non-specific
3. Chemical adsorption is fast with increase pressure, it can not alter the amount.	3. In Physisorption, when pressure increases the amount of adsorption increases.
4. When temperature is raised chemisorption first increases and then decreases.	4. Physisorption decreases with increase in temperature.
5. Chemisorption involves transfer of electrons between the adsorbent and adsorbate.	5. No transfer of electrons
6.Heat of adsorption is high i.e., from 40-400kJ/mole.	6. Heat of adsorption is low in the order of 40kJ/mole.
7. Monolayer of the adsorbate is formed.	7. Multilayer of the adsorbate is formed on the adsorbent.

3. In case of chemisorption, why adsorption first increases and then decreases with temperature?

- With increase in temperature , chemisorption first increases as sufficient energy is being provided by molecules to reach the activation energy.
- But after certain degree it decreases , as the further high temperature helps in breaking of the bond between the adsorbate and adsorbed molecules .

4. Which will be adsorbed more readily on the surface of charcoal and why NH_3 or CO_2

(i) The gases having low critical temperature are adsorbed slowly ,while gases with high critical temperature are adsorbed readily.

(ii)Among CO_2 and NH_3 ,NH_3will be more readily adsorbed on the surface of the charcoal This is because the critical temperature of ammonia gas is quite high than the CO_2.Hence the it is easily combines with the materials than the CO_2 whether is solid ,liquid , gases.

5. Heat of adsorption is greater for chemisorption than physisorption. Why?

- Chemisorption has higher heat of adsorption ,because in chemisorption the chemical bonds are much stronger.
- In adsorbed state the adsorbate is hold on the surface of adsorbent by attractive forces.
- And chemisorption is irreversible one.Therefore heat of adsorption is greater in chemisorption than the physisorption.

- Chemisorption - Heat of adsorption range 40-400KJ/mole.

6. In a coagulation experiment 10 mL of a colloid (X) is mixed with distilled water and 0.1M solution of an electrolyte AB so that the volume is 20 mL. It was found that all solutions containing more than 6.6 mL of AB coagulate with in 5 minutes. What is the flocculation values of AB for sol (X)?

A minimum of 6.6ml of AB is required to coagulate the sol

The moles of AB in the sol $= \frac{6.6 \times 0.01}{20} = 0.0033\ moles$

This means that a minimum of 0.033 moles or 0.0033 × 1000 = 3.3 milli moles are required for coagulating one litre of sol

Flocculation value of sol for X is **3.3**

7. Peptising agent is added to convert precipitate into colloidal solution. Explain with an example.

(i)Ions either positive or negative or peptizing agent are adsorbed on the particles pf precipitate.They repel and heat each other and break the particle of precipitate into colloidal size.

(ii)For example when we add a small volume of very dilute hydrochloric acid solution peptising agent to fresh precipitate of a silver chloride colloidal solution.

$$\underset{\text{Precipitate}}{AgCl} \xrightarrow{HCl} \underset{\text{Colloid}}{AgCl}$$

8.What happens when a colloidal sol of $Fe(OH)_3$ and AS_2O_3 are mixed?

When a colloidal sol of $Fe(OH)_3$ (positive sol)and AS_2O_3 (negative sol) are mixed , mutual coagulation occurs which causes precipitation.

$$\mathbf{Fe(OH)_3 + AS_2O_3 \rightarrow Fe_2S_3 + As(OH)_3}$$

9. What is the difference between a sol and a gel?

Sol	Gel
1.The liquid state of colloidal solution is called sol.	1.The solid or semi solid state of colloidal solution is called gel.
2.The sol does not have definite structure.	2.The gel possesses honey comb like structure.
3.The dispersion medium of sol may be water.	3.The dispersion medium of gel will be hydrated colloid particles.
4.The sol can be converted into gel by cooling	4.The gel can be converted into sol by heating.
5.The sol can be easily dehydrated.	5.The gel cannot be dehydrated.
6.The viscosity of sol is very low.	6.The viscosity of gel is very high
Example: Blood	**Example:**Fruit Jelly,Cooked gelatin jelly

10. Why are lyophillic colloidal sols are more stable than lyophobhic colloidal sol.

(i)A lyophillic colloid sols are stable due to charge and hydration of sol particles.

(ii) Lyophilic sols more stable than lyophobic sols because they are highly hydrated in the solution. And since more is the hydration more will be its stability.

(iii)Lyophilic sols are stabilized by electrostatic charge and hydration where as lyophobic sols are only stabilized by charge ,so they are easily get coagulated and requires stabilising agent .Hence lyophilic sols are more stable than the lyophobic sols.

11. Addition of Alum purifies water. Why?

Purification of drinking water is activated by coagulation of suspended impurities in water using alums containing Al^{3+}.That is we are adding with purify water.

12. What are the factors which influence the adsorption of a gas on a solid?

(i)Nature of the gas

- The nature of adsorbate can influence the adsorption.
- Gases like SO_2 ,NH_2 ,HCl and CO_2 are easily liquefiable as have greater van der waal's force of attraction.
- On the other hand, permanent gases like H_2 ,N_2 and O_2 can not be liquefied easily.
- These permanent gases are having low critical temperature and adsorbed slowly, while gases with high critical temperature are adsorbed readily.

(ii)surface area of the solid

As the adsorption is a surface phenomenon it depends on the surface area of adsorbent. i.e., higher the surface area, higher is the amount adsorbed.

(iii)Effect of pressure

When pressure increases, adsorption becomes steadily increase in case of chemisorption and increases in case of physisorption.

(iv)Effect of temperature

Chemical adsorption is fast with increase pressure, it can not alter the amount. In Physisorption, when pressure increases the amount of adsorption increases

13. What are enzymes? Write a brief note on the mechanism of enzyme catalysis.

- Enzymes are complex protein molecules with three dimensional structures.
- They catalyse the chemical reaction in living organism.
- They are often present in colloidal state and extremely specific in catalytic action.
- Each enzyme produced in a particular living cell can catalyse a particular reaction in the cell.
- The following mechanism is proposed for the enzyme catalysis

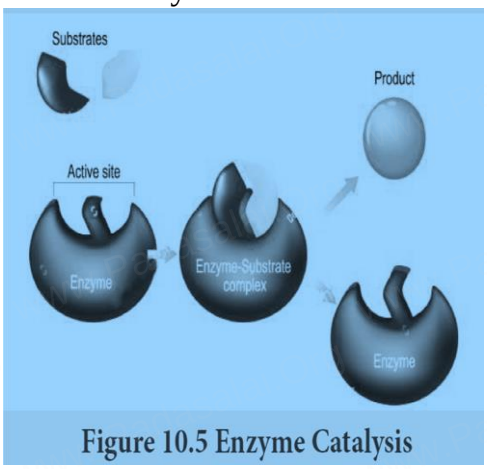


Figure 10.5 Enzyme Catalysis

Step 1 : Formation of enzyme substrate complex

E + S ⇋ ES

(Enzyme) (substrate) (complex)

Step 2 : Dissociation of enzyme – substrate complex to form product

ES ⇋ E P

(Complex) (Enzyme) (Product)

14. What do you mean by activity and selectivity of catalyst?

Activity of catalyst

It is an ability of catalyst to accelerate the rate of the reaction .It mostly depends on Chemisorption strength

Selectivity of the catalyst

It is an ability of catalyst to direct reaction to yield particular product i.e one catalyst cannot be catalyst for other reaction

15. Describe some feature of catalysis by Zeolites.

(i) Zeolites are microporous, crystalline, hydrated, alumino silicates, made of silicon and aluminium tetrahedra.

(ii) There are about 50 natural zeolites and 150synthetic zeolites. As silicon is tetravalent and aluminium is trivalent, the zeolite matrix carries extra negative charge. To balance the negative charge, there are extra framework cations for example, H^+ or Na^+ ions.

(iii) Zeolites carring protons are used as solid acids, catalysis and they are extensively used in the petrochemical industry for cracking heavy hydrocarbon fractions into gasoline, diesel,etc.

(iv) Zeolites carring Na^+ ions are used as basic catalysis.

(v) One of the most important applications of zeolites is their shape selectivity. In zeolites, the active sites namely protons are lying inside their pores. So, reactions occur only inside the pores of zeolites.

Reactant selectivity

When bulkier molecules in a reactant mixture are prevented from reaching the active sites within the zeolite crystal, this selectivity is called reactant shape selectivity.

Transition state selectivity

If the transition state of a reaction is large compared to the pore size of the zeolite, then no product will be formed.

Product selectivity

It is encountered when certain product molecules one too big to diffuse out of the zeolite pores.

16. Give three uses of emulsions.

(i)The cleansing action of soap is due to emulsion.
(ii)It is used im the preparation of vanishing creams.
(iii)It is used in preparation of cold liver oil.

17. Why does bleeding stop by rubbing moist alum

- Blood is a colloidal sol.
- When we rub the injured part with the moist alum then coagulation of blood take place
- Hence main reason is coagulation of blood ,which stop the bleeding .
- Therefore the bleeding stop by rubbing moist alum.

18. Why is desorption important for a substance to act as good catalyst?

- Desorption is important for a substance to act as good catalyst, so that after the reaction the products found on the surface separate out to create free surface again for other reactant molecules to approach the surface and react.
- If desorption does not occur the other reactants are left with no space on the catalysts surface for adsorption and reaction will stop.

19. Comment on the statement: Colloid is not a substance but it is a state of substance.

- The statement is true.
- Because the same substances may exist as a colloid under certain condition and as a crystalloid under certain other conditions.
- For example ,Nacl in water behaves as a crystalloid while in benzene ,it behaves as a colloid Similarly dilute soap solution behave like a crystalloid while concentrated solution behaves as a colloid.It is the size of the particles which matter.that is the state which the substances exists .
- If the size of the particles lies in the range 1nm to 100 nm,it is in the colloidal state.

20. Explain any one method for coagulation

(i) Electrophoresis:

In the electrophoresis, charged particles migrate to the electrode of opposite sign. It is due to neutralization of the charge of the colloids. The particles are discharged and so they get precipitated.

(ii) By mixing two oppositively charged sols

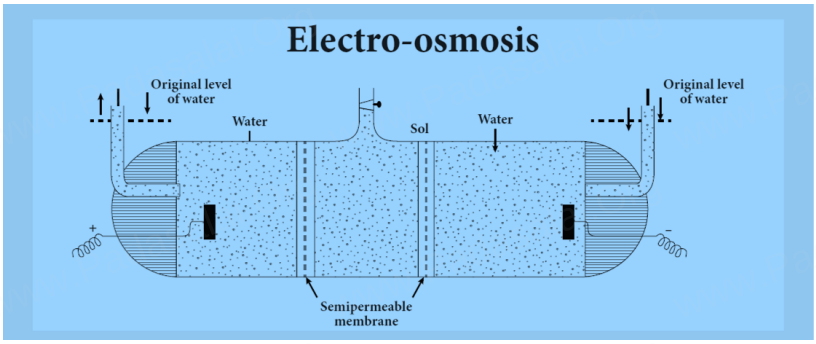
When colloidal sols with opposite charges are mixed mutual coagulation takes place. It is due to migration of ions from the surface of the particles.

(iii) By boiling

When boiled due to increased collisions, the sol particles combine and settle down.

21. Write a note on electro osmosis

- A sol is electrically neutral. Hence the medium carries an equal but opposite charge to that of dispersed particles.
- When sol particles are prevented from moving, under the influence of electric field the medium moves in a direction opposite to that of the sol particles.
- This movement of dispersion medium under the influence of electric potential is called electro osmosis.



22. Write a note on catalytic poison

Certain substances when added to a catalysed reaction decreases or completely destroys the activity of catalyst and they are often known as catalytic poisons.

Example : $2SO_2 + O_2 \xrightarrow{Pt} 2SO_3$

In the above reaction Pt catalyst, the poison is As_2O_3 i.e., As_2O_3 destroys the activity of Pt

23. Explain intermediate compound formation theory of catalysis with an example

- A catalyst acts by providing a new path with low energy of activation.
- In homogeneous catalysed reactions a catalyst may combine with one or more reactant to form an intermediate which reacts with other reactant or decompose to give products and the catalyst is regenerated.

Consider the reactions:

A+B → AB……. (1)

A+C → AC (intermediate) ……..(2)

C is the catalyst

AC+B → AB+C…… (3)

Activation energies for the reactions (2) and (3) are lowered compared to that of (1).

Hence the formation and decomposition of the intermediate accelerate the rate of the reaction.

Oxidation of HCl by air in presence of CuCl2.

$2CuCl_2 \rightarrow Cl_2 + Cu_2Cl_2$

$2Cu_2Cl + O_2 \rightarrow 2Cu_2OCl$

It is an intermediate.

$2Cu_2OCl_2 + 4HCl \rightarrow 2H_2O + 4CuCl_2$

This theory describes

(i) the specificity of a catalyst and

(ii) the increase in the rate of the reaction with increase in the concentration of a catalyst.

Limitations

(i) The intermediate compound theory fails to explain the action of catalytic poison and activators (promoters).

(ii) This theory is unable to explain the mechanism of heterogeneous catalysed reactions

24. What is the difference between homogenous and hetrogenous catalysis?

Homogeneous Catalysis	Heterogenous Catalysis
1.In a catalysed reaction the reactants,products and catalyst are present in the same phase	1.In a reaction the catalyst are present in a different phase.i.e catalyst is not present in the same phase as that of reactants and products.
2.Homogeneous catalysis explained by intermediate formation compound theory.	2.Heterogenelous catalysis explained by adsorption theory.
3.**Example :** $2SO_2+O_2+[NO] \rightarrow 2SO_3+[NO]$ **Reactant** ($2SO_2+O_2$) , **catalyst** ([NO]) , **Product** (SO_3) are present in the gaseous form.	3.$2SO_2 + O_2 \xrightarrow{Pt} 2SO_3$ **Reactant** (SO_2 , O_2) , **Catalyst** (Pt) are in different phase

25. Describe adsorption theory of catalysis.

- Langmuir explained the action of catalyst in heterogeneous catalysed reactions based on adsorption. The reactant molecules are adsorbed on the catalyst surfaces, so this can also be called as contact catalysis.

- According to this theory, the reactants are adsorbed on the catalyst surface to form an activated complex which subsequently decomposes and gives the product.

The various steps involved in a heterogeneous catalysed reaction are given as follows:
1. Reactant molecules diffuse from bulk to the catalyst surface.
2. The reactant molecules are adsorbed on the surface of the catalyst.
3. The adsorbed reactant molecules are activated and form activated complex which is decomposed to form the products.
4. The product molecules are desorbed.
5. The product diffuse away from the surface of the catalyst.

The adsorption theory explains the following
i. Increase in the activity of a catalyst by increasing the surface area. Increase in the surface area of metals and metal oxides by reducing the particle size increases the rate of the reaction
ii. The action of catalytic poison occurs when the poison blocks the active centres of the catalyst.
iii. A promoter or activator increases the number of active centres on the surfaces.

Book inside Short answers

1.Prove that adsorption is a surface phenomenon

Solid surfaces have the ability to attract the contacting species due to free valency or residual force on them. For example,
(i) charcoal adsorbs ammonia
(ii) silica gel adsorbs water

2.Define adsorbate , adsorbent , Interface , types of adsorption based on concentration

Adsorbent is the material on which adsorption takes place.
Adsorbed substance is called an **adsorbate**.
The surface of separation of the two phases where the concentration of adsorbed molecule is high is known as **interface**.
In adsorption, if the concentration of a substance in the interface is high, then it is called **positive adsorption**. If it is less, then it is called **negative adsorption**.

3.What are Characteristics of adsorption

1. It can occur in **all interfacial surfaces** i.e. the adsorption can occur in between gas-solid, liquid solid, liquid-liquid, solid- solid and gas-liquid.
2. It is always accompanied by decrease in free energy. When ΔG reaches zero, the equilibrium is attained.
3. It is a **spontaneous process**.
4. When molecules are adsorbed, there is always a **decrease in randomness** of the molecules.

4.What are Homogeneous catalysis and Heterogeneous catalysis explain with an one example
Homogeneous catalysis

In a catalysed reaction, the reactants, products and catalyst are present in the **same phase**
$2SO_2+O_2+[NO] \rightarrow 2SO_3+[NO]$
Reactant ($2SO_2+O_2$) , catalyst ([NO]) , Product (SO_3) are present in the gaseous form.

Heterogeneous catalysis

In a reaction, the catalyst is present in a **different phase** i.e. It is not present in the same

phase as that of reactants or products. This is generally referred as contact catalysis
In the manufacture of sulphuric acid by contact process SO_3 is prepared by the action of SO_2 and O_2 in the presence of Pt or V2O5 as a catalyst.

$$2SO_2 + O_2 \xrightarrow{Pt} 2SO_3$$

Reactant (SO_2 , O_2) , Catalyst (Pt) are in different phase

5.Define promoters with example

- In a catalysed reaction the presence of a certain substance increases the activity of a catalyst. Such a substance is called a promoter.

Example - Haber's process of manufacture of ammonia, the activity of the iron catalyst is increased by the presence of molybdenum. Hence molybdenum is called a promoter.

6.Define aquasols , alcosol , benzosol

If the dispersion medium considered is water, then the colloids are referred as hydrosols or aquasols.
If the dispersion medium is an alcohol, the colloid is termed as alcosol, and if benzene is the dispersion medium, it is called as benzosol.

7.Define Auto catalysis with example

- In certain reactions one of the products formed acts as a catalyst to the reaction.
- Initially the rate of reaction will be very slow but with the increase in time the rate of reaction increases.

$CH_3COOC_2H_5+H_2O \rightarrow CH_3COOH+C_2H_5OH$
Acetic acid acts as the autocatalyst

8.Define negative catalysis with example

In certain reactions, presence of certain substances, decreases the rate of the reaction.
$4CHCl_3+3O_2 \rightarrow 4COCl_2+2H_2O+2Cl_2$
Ethanol decreases the rate of the reaction

9.Define active centres

- The surface of a catalyst is not smooth.
- It bears steps, cracks and corners. Hence the atoms on such locations of the surface are
- co-ordinatively unsaturated. So, they have much residual force of attraction. Such sites are called active centres. So, the surface carries high surface free energy.
- The presence of such active centres increases the rate of reaction by adsorbing and
- activating the reactants.

10.Write the differences between lyophobic and lyophillic sol

Lyophillic sols	Lyophobic sols
In this definite attractive force or affinity exists between dispersion medium and dispersed phase	There will be no attractive force exists between the dispersed phase and dispersion medium.
They are more stable and will not get precipitated easily.	They are more stable and will not get precipitated easily.

They can be brought back to colloidal solution even after the precipitation by addition of the dispersion medium.	They cannot be produced again by just adding the dispersion medium.
Examples: sols of protein and starch.	**Examples:** sols of gold, silver, platinum and copper.

11.Explain how colloids are purified by Dialysis

- Electrolyte are separated from a colloid using a semipermeable membrane (dialyser).
- In this method, the colloidal solution is taken in a bag made up of semipermeable membrane.
- It is suspended in a trough of flowing water, the electrolytes diffuse out of the membrane and they are carried away by water.

12.Factors on which Colour of the sol depends

- Method of preparation
- Wavelength of source of light.
- Size and shape of colloidal particle
- Whether the observer views the reflected light or transmitted light.

13.Define Gold number

- Gold number is defined as the number of milligrams of hydrophilic colloid that will
- just prevent the precipitation of 10ml of gold sol on the addition of 1ml of 10% NaCl solution.
- Smaller the gold number greater the protective power.

14.What are the different types of emulsifiers ?

- Most of the lyophillic colloids also act as emulsifiers. Example: glue, gelatine.
- Long chain compounds with polar groups like soap and sulphonic acids.
- Insoluble powders like clay and lamp black also a act as emulsifiers.

15. Define Inversion of Phase

The change of W/O emulsion into O/W emulsion is called inversion of phases.

For example:

An oil in water emulsion containing potassium soap as emulsifying agent can be converted into water in oil emulsion by adding CaC_{l2} or $AlCl_3$.

16.How natural honey is distinguished from artificial honey ?

- On adding ammoniacal $AgNO_3$ natural honey a metallic silver is produced, assumes a reddish yellow color due to traces of albumin or ethereal oil which acts as a protective colloid.
- On adding ammoniacal $AgNO_3$ artificial honey a dark yellow or greenish yellow precipitate is formed.

Unit – 12 Carbonyl Compounds

Book inside one marks

1. Give the common and IUPAC name of the compound $HO\text{-}CH_2\text{-}\underset{\displaystyle OH}{\underset{|}{CH}}\text{-}CHO$

a) glyceraldehyde, hydroxyl propanal
b) glyceraldehyde, 2,3 - dihydroxy propanal
c) crotonaldehyde, hydroxyl propanal
d) crotonaldehyde, 2,3 - dihydroxy propanal

2. Which among the following on oxidation with alk.$KMnO_4$ will give butanone?
a) Butan -1- ol **b) Butan -2- ol**
c) Both (a) and (b)
d) neither (a) nor (b)

4. Which among the carbonyl compounds cannot be prepared by Rosenmund reduction?
a) Ketones b) Formaldehyde
c) Acetaldehyde **d) both (a) and (b)**

5. A compound 'X' when mixed with ethanol and a drop of concentrated H_2SO_4 gave a compound with fruity odour. Identify 'X'.
a) HCHO b) CH_3OH
c) CH_3COOH d) CH_3NH_2

6. Isopropyl alcohol vapours with air over silver catalyst at 520K gives
a) tert.butyl alcohol b) acetaldehyde
c) acetone d) 2-propanol

7. Methyl ketones are usually characterized by
a) the Fehling's solution
b) the iodoform test
c) the Schiff's test
d) the tollen's test

8. When acetaldehyde is heated with Fehling's solution, it gives a precipitate of
a) Cu_2O b) CuO
c) CuO + Cu_2O d) Cu

9. Tincture brnzoin is obtained from
a) benzoyl chloride **b) benzoin**
c) benzyl alcohol d) benzoic acid

10. Hydrogenation of benzoyl chloride in the presence of Pd on $BaSO_4$ gives
a) phenol b) benzoic acid
c) benzyl alcohol **d) benzaldehyde**

11. Calcium acetate + calcium benzoate $\xrightarrow{distillation}$ give
a) benzophenone b) benzaldehyde
c) acetophenone d) phenyl benzoate

12. Bakelite is a product of reaction between
a) formaldehyde and NaOH
b) phenol and methanal
c) aniline and NaOH
d) phenol and chloroform

13. The common name of $CH_3\text{-}CH{=}CH\text{-}CHO$
a) acraldehyde **b) crotonaldehyde**
c) cinnamaldehyde d) isobutyraldehyde

14. Aldehydes are functional isomers of
a) ethers b) alcohols
c) ketones d) esters

15. Pick out the compound that reduces Tollen's reagent and Fehling's solution.
a) CH_3CHO b) CH_3COCH_3
c) CH_3COOH d) both (a) and (b)

16. Formaldehyde reacts with ammonia to give
a) $(CH_2)_4N_6$ b) $(CH_2)_5N_5$
c) $(CH_2)_6N_4$ d) $(CH_2)_6N_3$

17. The acid that cannot be prepared by Grignard reagent
a) acetic acid **b) formic acid**
c) butyric acid d) benzoic acid

18. Which order of arrangement is correct in terms of the strength of the acid
a) CH_3-$CH_2COOH > CH_3COOH < HCOOH < ClCH_2COOH$
b) $ClCH_2COOH < HCOOH < CH_3COOH < CH_3CH_2COOH$
c) CH_3-$CH_2COOH < CH_3COOH < HCOOH < ClCH_2COOH$
d) $HCOOH > CH_3CH_2COOH < CH_3COOH > ClCH_2COOH$

19. When chlorine is passed through acetic acid in presence of red phosphorous, it forms
a) acetyl chloride
b) trichloro acetaldehyde
c) trichloro acetic acid
d) methyl chloride

20. Which of the following compounds will react with $NaHCO_3$ solution to give sodium salt and CO_2?
a) Acetic acid b) n-hexanol
c) Phenol d) Both (a) and (c)

21. Carboxylic acids are more acidic from phenol and alcohol because of
a) intermolecular hydrogen bonding
b) formation of dimmers
c) highly acidic hydrogen
d) greater resonance stabilisation of their conjugate base.

22. The high boiling points of carboxylic acids is due to
a) weak vanderwaal's forces
b) intermolecular hydrogen bonding.
c) intramolecular hydrogen bonding.
d) delocalisation of π electrons.

23. Schiffs reagent gives pink colour with
a) acetone **b) acetaldehyde**
c) ethyl alcohol d) methyl acetate

24. Which of the following compounds is oxidized to give ethyl methyl ketone?
a) 2-propanol b) 2-pentanone
c) 1-butanol **d) 2-butanol**

25. Tollen's reagent is
a) ammoniacal cuprous chloride
b) ammoniacal cuprous oxide
c) ammoniacal silver nitrate
d) ammoniacal silver chloride

26. The compound that does not undergo Cannizzaro reaction is
a) formaldehyde **b) acetaldehyde**
c) benzaldehyde d) trimethyl acetaldehyde

27. The formation of cyanohydrin from a ketone is an example
a) electrophilic addition
b) nucleophilic addition
c) nucleophilic substitution
d) electrophilic substitution

28. Aldol obtained from acetaldehyde is
a) 2-hydroxy butanol b) 3-hydroxy butanol
c) 3-hydroxy butanal
d) 2-hydroxy butanal

29. In the reduction of acetaldehyde using LiAlH4 the hydride ion acts as
a) electrophile **b) nucleophile**
c) both (a) and (b) d) a free radical

30. A cyanohydrin of a compound X on hydrolysis gives lactic acid. The X is
a)HCHO b) $(CH_3)_2CO$
c) CH_3CHO d) $C_6H_5CH_2CHO$

31.The compound which does not reduce Fehling solution is
a) formaldehyde b) acetaldehyde
c) benzaldehyde d) propionaldehyde

Book Back

1. How is propanoic acid is prepared starting from
(a) an alcohol (b) an alkylhalide (c) an alkene

(a) $CH_3 - CH_2 - CH_2 - OH \xrightarrow{H^+/K_2Cr_2O_7} CH_3 - CH_2 - COOH$
(1-Propanol) (Propionicacid)

(b) $CH_3 - CH_2 - Br \xrightarrow{Mg/ether} CH_3 - CH_2 - MgBr \xrightarrow{CO_2 \ / \ H_3O^+} CH_3 - CH_2 - COOH + MgBr(OH)$

(c) $CH_2 = CH_2 \xrightarrow{HCl} CH_3 - CH_2 - Cl \xrightarrow{NaCN} CH_3 - CH_2 - CN \xrightarrow{H_3O^+} CH_3 - CH_2 - COOH$

2. A Compound (A) with molecular formula C_2H_3N on acid hydrolysis gives(B) which reacts with thionylchloride to give compound(C). Benzene reacts with compound (C) in presenceof anhydrous $AlCl_3$ to give compound(D). Compound (C) on reduction with gives (E). Identify (A), (B), (C) , D, E. Write the equations. Identify X and Y.

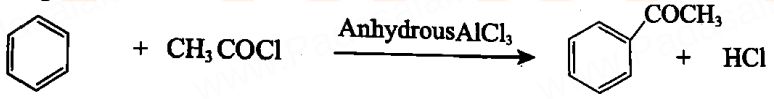
(i)compound A C_2H_3N which is methyl cyanide which on hydrolysis gives acetic acid

$CH_3 - CN \xrightarrow{H_3O^+ \ (excess)} CH_3 - COOH$
(A) (B)

(ii) Acetic acid reacts with thionyl chloride to give acetyl chloride

$CH_3COOH \xrightarrow{SOCl_2} CH_3COCl + SO_2 + HCl$
(B) (C)

(iii))Benzene reacts with acetyl chloride in presence of anhydrous $AlCl_3$ to give acetophenone



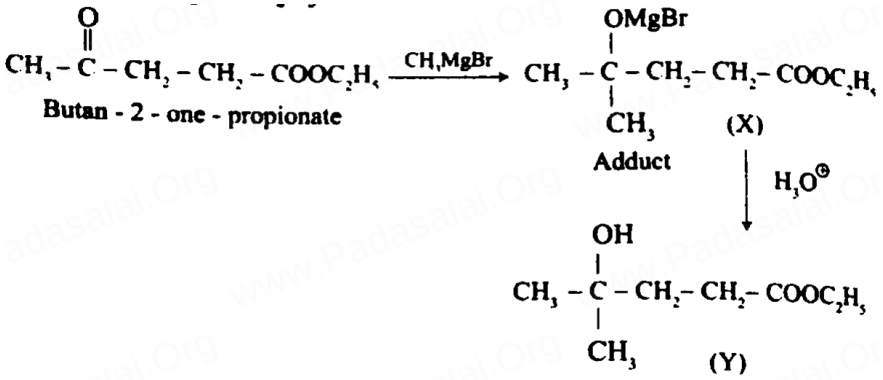
Benzene (C) (Acetophenone)

(iv) Compound (C) on reduction with gives acetaldehyde (E)

$CH_3COCl + H_2 \xrightarrow{Pd/BaSO_4} CH_3CHO + HCl$
(Acetaldehyde)

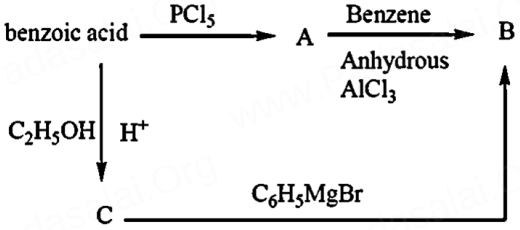
Compound	Name
A	Methyl cyanide
B	Acetic acid
C	Acetyl chloride
D	Acetophenone
E	Acetaldehyde

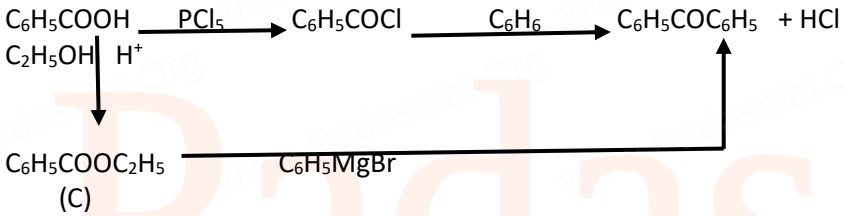
3. $CH_3COCH_2CH_2COOC_2H_5 \xrightarrow{CH_3MgBr} X \xrightarrow{H_3O^+} Y$



2 -methyl -butan – 2-hydroxy propionate

4. Identify A, B and C

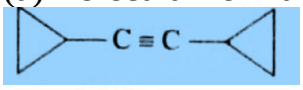




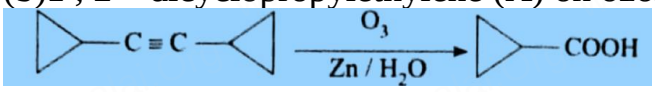
A – Benzoyl chloride B – Benzophenone C – Ethyl benzoate

5. A hydrocarbon A molecular formula (C_8H_{10}) on ozonolysis gives B($C_4H_6O_2$) only. Compound C(C_3H_5Br) on treatment with magnesium in dry ether gives (D) which on treatment with CO_2 followed by acidification gives(B). Identify A, B and C.

(a)Molecular formula C_8H_{10} is 1 , 2 – dicyclopropylethylene

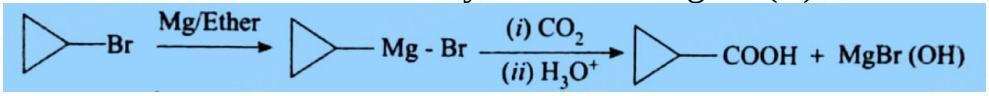


(b)1 , 2 – dicyclopropylethylene (A) on ozonolysis to give cyclopropyl carboxylic acid



(A) (B)

(c) Compound C(C_3H_5Br) on treatment with magnesium in dry ether gives (D)) which on treatment with CO_2 followed by acidification gives(C)



(C) (D) (B)

A - 1 , 2 – dicyclopropylethylene **B** - cyclopropyl carboxylic acid
C – Bromocyclo propane **D** – Cyclo propyl magnesium bromide

6.Identify A, B, C and D

Ethanoic acid $\xrightarrow{SOCl_2}$ **A** $\xrightarrow{Pd/BaSO_4}$ **B** $\xrightarrow{NaOH}$ **C** $\xrightarrow{\Delta}$ **D**

Ethanoic acid $\xrightarrow{SOCl_2}$ CH_3COCl $\xrightarrow{H_2\ /\ Pd/BaSO_4}$ $CH_3CHO + HCl$

(A) (B)

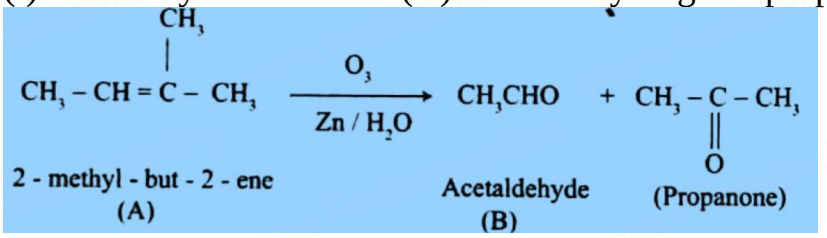
(B) $\xrightarrow{NaOH}$ CH_3-$CH(OH)$-CH_2-CHO (C)

(C) $\xrightarrow[-H_2O]{\Delta}$ CH_3-CH=CH-CHO (D)

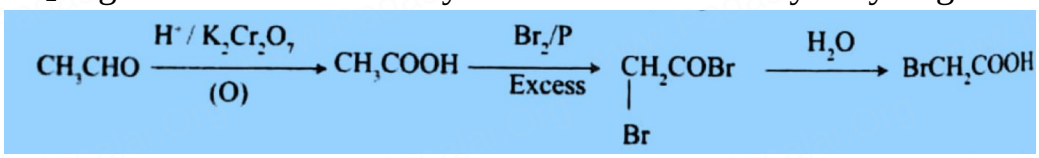
Compound	Name
A	Acetyl chloride
B	Acetaldehyde
C	3 – hydroxy butanal
D	Crotanaldehyde

7. An alkene (A) on ozonolysis gives propanone and aldehyde (B). When (B) is oxidised (C) is obtained. (C) is treated with Br_2/P gives (D) which on hydrolysis gives (E). When propanone is treated with HCN followed by hydrolysis gives (E). Identify A, B, C, D and E.

(i).2 – methyl -but -2 -ene (A) on ozonolysis gives propanone and acetaldehyde

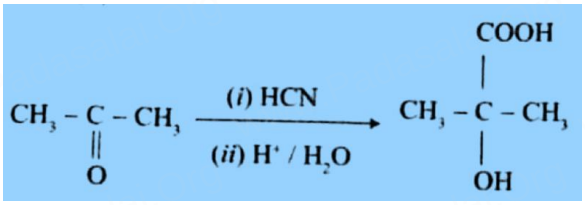


(ii). When acetaldehyde is oxidised acetic acid is obtained. Acetic acid is treated with Br_2/P gives Monobromo acetyl bromide which on hydrolysis gives monobromo acetic acid.



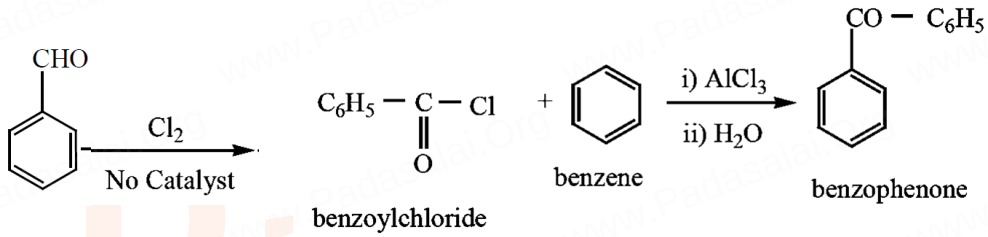
(B) (C) (D) (E)

(iii)When propanone is treated with HCN followed by 2- methyl -2 – hydroxy propionic acid



Compound	Name
A	2 – methyl -but -2 -ene
B	Acetaldehyde
C	Acetic acid
D	Monobromo acetyl bromide
E	Monobromo acetic acid
F	2- methyl -2 – hydroxy propionic acid

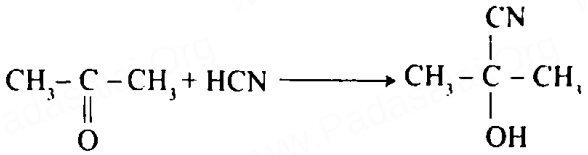
8. How will you convert benzaldehyde into the following compounds?
(i) benzophenone (ii) benzoic acid (iii)2 -hydroxyphenylaceticacid
(i)



(ii) $C_6H_5CHO \xrightarrow{KMnO_4/(O)} C_6H_5COOH$
Benzaldehyde Benzoic acid

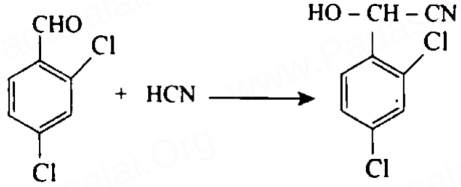
(iii)

9. What is the action of HCN on (i) propanone (ii) 2,4-dichlorobenzaldehyde.
(i)Action of HCN on propanone



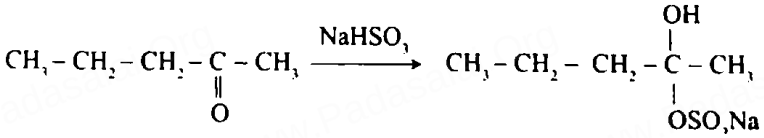
Cyanohydrin

(ii)Action of HCN on 2,4-dichlorobenzaldehyde.



2 , 4 – dichlorobenzaldehyde cyanohydrin

10. A carbonyl compound A having molecular formula $C_5H_{10}O$ forms crystalline sodium bisulphate and gives positive iodoform test. A does not reduce Fehling solution. Identify A.

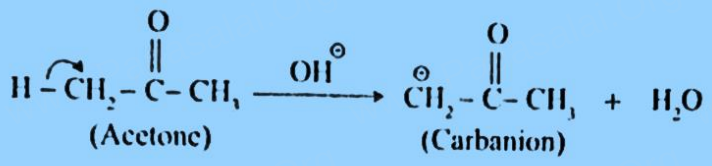


Pentan – 2 – one **white crystalline precipitate**

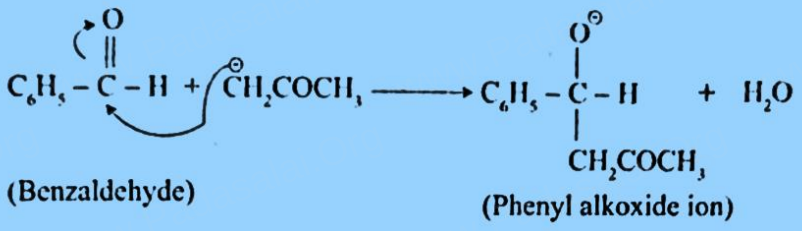
Pentan – 2 -one gives positive iodoform test which does not reduce Fehling's solution

11.Write the structure of the major product of the aldol condensation of benzaldehyde with acetone.

Step 1:



Step 2:



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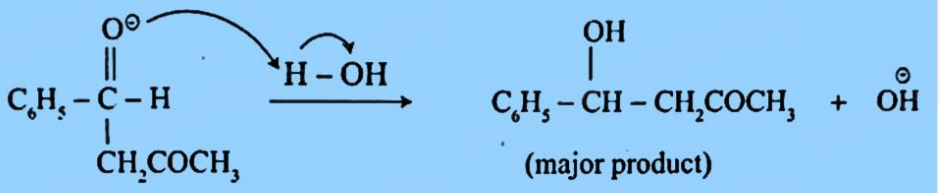
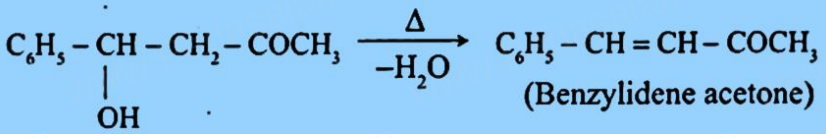
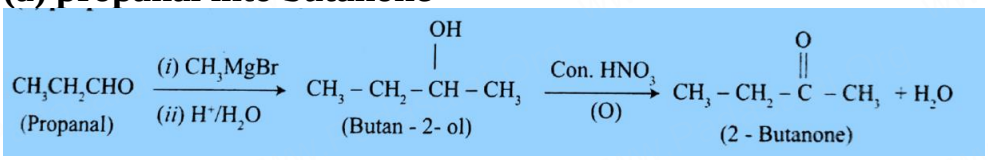


Step 4:

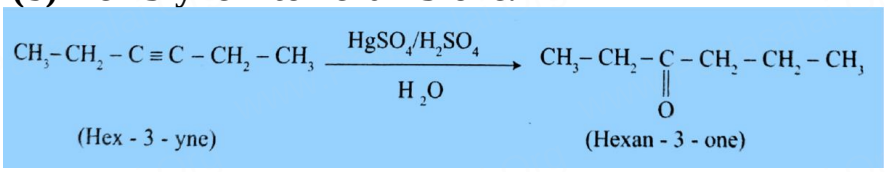


12.How are the following conversions effected

(a) propanal into butanone



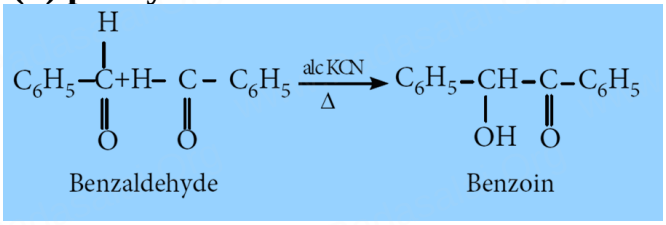
(b) Hex-3-yne into hexan-3-one.



(c) phenylmethanal into benzoic acid

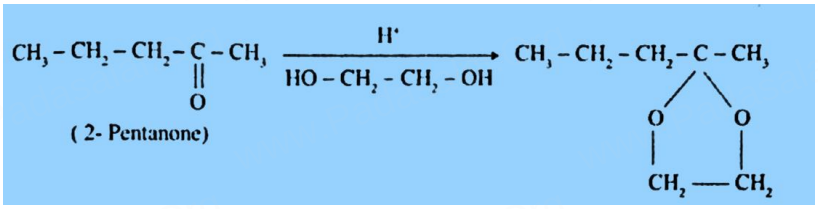
$$C_6H_5CHO \xrightarrow[(O)]{KMnO_4} C_6H_5COOH$$

(d) phenylmethanal into benzoin

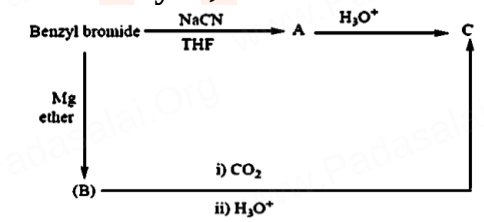


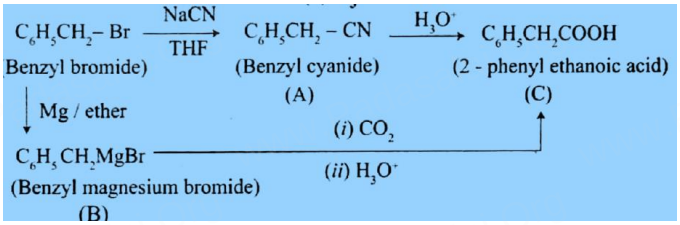
13.Complete the following reaction.

$$CH_3\text{-}CH_2\text{-}CH_2\text{-}C(=O)\text{-}CH_3 \xrightarrow{H^+/0H-CH_2-CH_2-CH_2-OH} ?$$



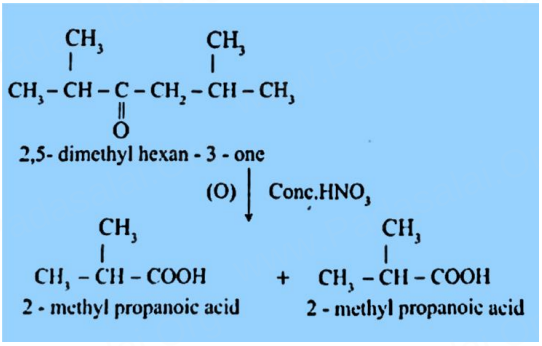
14.Identify A, B and C





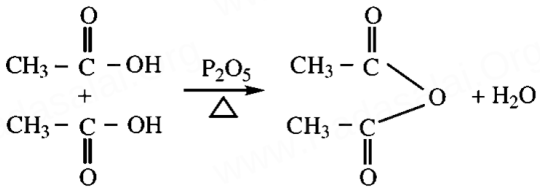
A – Benzyl cyanide **B** – Benzyl magnesium bromide **C** – 2 – phenyl ethanoic acid

15.When ketones are undergoes oxidation , the C-C bond is cleaved .When a strong oxidizing agent is used to oxidize 2 , 5 – dimethyl butan-3-one .Mention the products with their names



16.How will you convert following conversion ?

(i).Acetic acid into acetic anhydride



(ii) Methyl acetate into ethyl acetate

$$CH_3COOCH_3 \xrightarrow{C_2H_5OH/H^+} CH_3COOC_2H_5 + H_2O$$

(iii) Methyl acetate into acetamide

$$CH_3CN \xrightarrow{H_3O^+} CH_3CONH_2$$

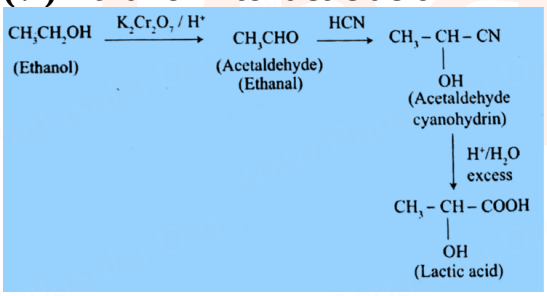
(iv)Acetyl chloride into acetophenone

$$CH_3COCl + C_6H_6 \xrightarrow{\text{anhydrous } AlCl_3} C_6H_5COCH_3 + HCl$$

(v)Sodium acetate into ethane

$$2CH_3COONa \xrightarrow{\text{Electrolysis}} CH_3 - CH_3 + 2CO_2 + 2Na$$

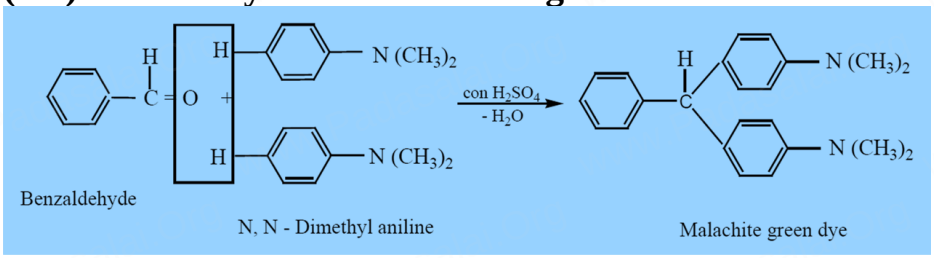
(vi) Ethanol into lactic acid



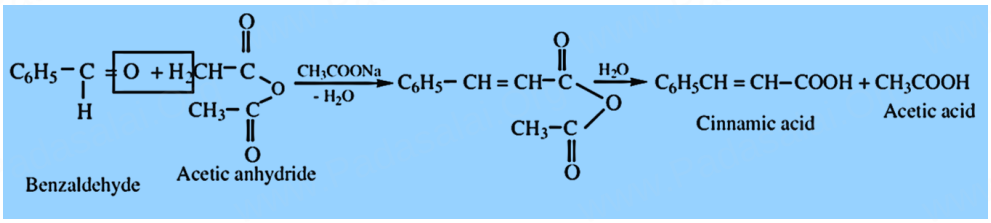
(vii)Toluene into benzoic acid

$$C_6H_5CH_3 \xrightarrow{KMnO_4/(O)} C_6H_5COOH$$

(viii)Benzaldehyde into malachite green

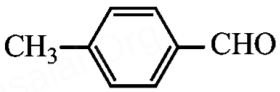


(ix)Benzaldehyde into cinnamic acid

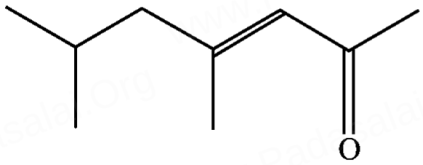


Evaluate yourself

1.Write the IUPAC name for the following

i) 

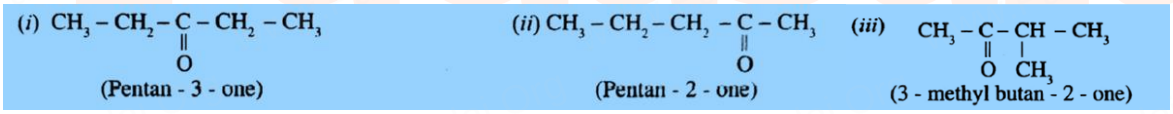
ii) $(CH_3)_2 C = CHCOCH_3$

iii) 

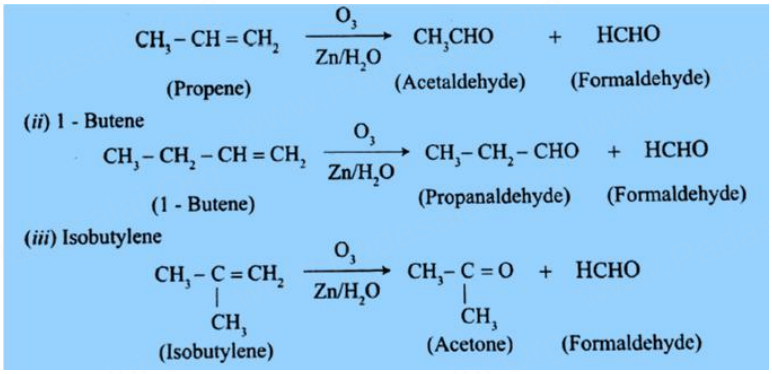
iv) $(CH_3)_2 C (OH) CH_2 CHO$

(i).4 – methyl benzaldehyde
(ii) 4 – methyl pent-3 -en-2 -one
(iii) 4 , 6 -Dimethyl hept -3 – en -2 -one
(iv) 3 – hydroxy -3 – methyl butan – 1-al

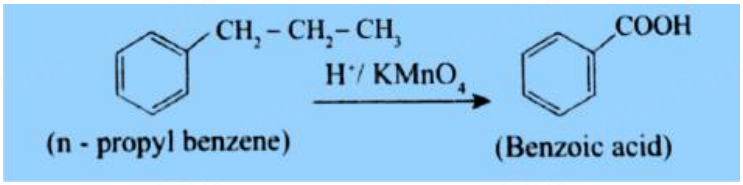
2. Write all possible structural isomers and position isomers for the ketone represented by the molecular formula $C_5H_{10}O$



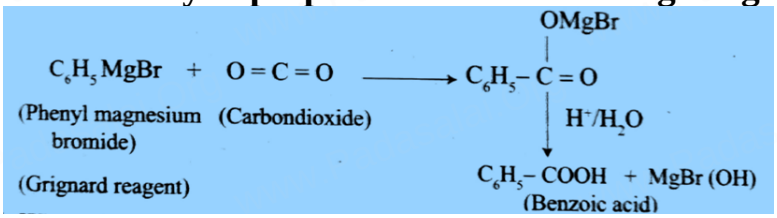
3. What happens when the following alkenes are subjected to reductive ozonolysis.
1) propene 2) 1 – Butene 3) Isobutylene



4.What happens when n – propyl benzene is oxidized using $H^+/KMnO_4$?



5.How will you prepare benzoic acid using Grignard reagent?



6.Why acid anhydride are preferred to acyl chloride for carrying out acylation reaction

i)Easily available ii)Cheap iii)Easy to prepare
iv)Easily undergo acylation without irritating odours

Book inside

Naming reaction

1. Rosenmund reduction

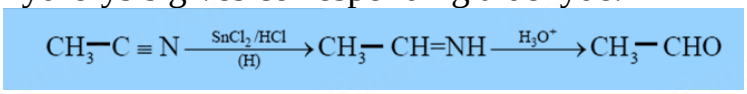
Aldehydes can be prepared by the hydrogenation of acid chloride, in the presence of palladium supported by barium sulphate. This reaction is called Rosenmund reduction

$$CH_3COCl + H_2 \xrightarrow{Pd/BaSO_4} CH_3CHO + HCl$$

(Acetaldehyde)

2.Stephen's reaction

When alkylcyanides are reduced using $SnCl_2$ / HCl , imines are formed, which on hydrolysis gives corresponding aldehyde.



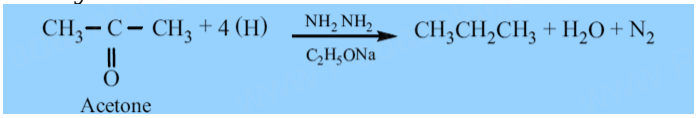
3. Clemmensen reduction

Aldehydes and Ketones when heated with zinc amalgam and concentrated hydrochloric acid gives hydrocarbons.

$$CH_3CHO \xrightarrow{Zn(Hg)/\ Conc.HCl} CH_3 - CH_3 + H_2O$$

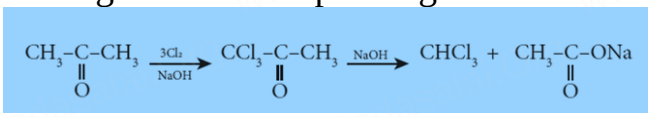
4. Wolf Kishner reduction

Aldehydes and Ketones when heated with hydrazine (NH_2NH_2) and sodium ethoxide, hydrocarbons are formed Hydrazine acts as a reducing agent and sodium ethoxide as a catalyst.



5. Haloform reaction

Acetaldehyde and methyl ketones, containing $CH_3-C(=O)-$ group, when treated with halogen and alkali give the corresponding haloform



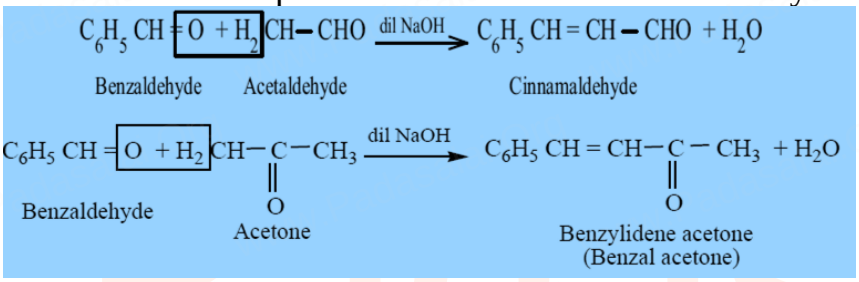
6.Crosssed Aldol condensation

Aldol condensation can also takes place between two different aldehydes or ketones or between one aldehyde and one ketone such an aldol condensation is called crossed or mixed aldol condensation.

$$\underset{\text{Methnanal}}{HCHO} + \underset{\text{Propanal}}{CH_3CHO} \xrightarrow{\text{dil.NaOH}} \underset{\text{3-hydroxy propanol}}{OH - CH_2 - CH_2 - OH}$$

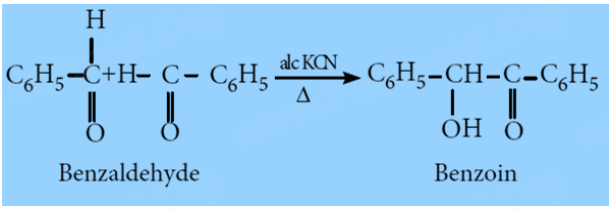
7. Claisen – Schmidt Condensation

Benzaldehye condenses with aliphatic aldehyde or methyl ketone in the presence of dil. alkali at room temperature to form unsaturated aldehyde or ketone.



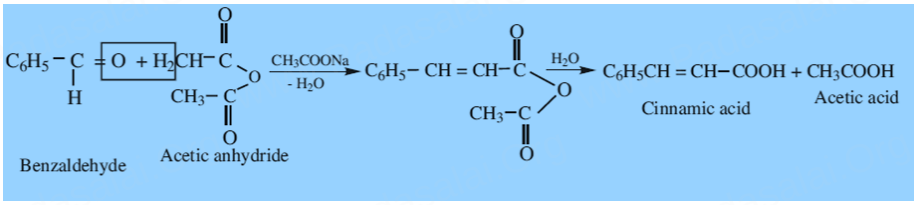
8. Benzoin condensation

The Benzoin condensation involves the treatment of an aromatic aldehyde with aqueous alcoholic KCN. The products are - hydroxyl ketone. Benzaldehyde reacts with alcoholic KCN to form benzoin



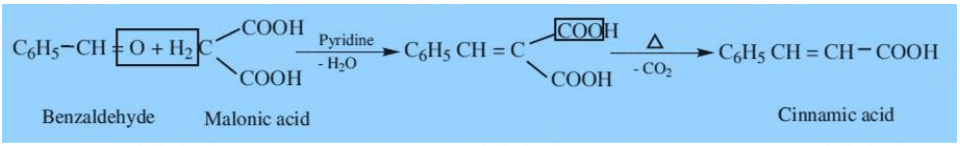
9. Perkins' reaction

When an aromatic aldehyde is heated with an aliphatic acid anhydride in the presence of the sodium salt of the acid corresponding to the anhydride, condensation takes place and an α, β unsaturated acid is obtained. This reaction is known as Perkin's reaction



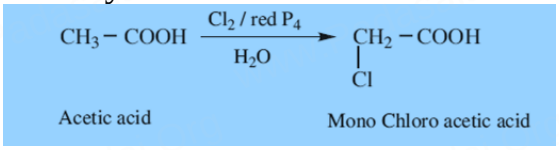
10.Knoevenagal reaction

Benzaldehyde condenses with malonic acid in presence of pyridine forming cinnamic acid, Pyridine act as the basic catalyst.



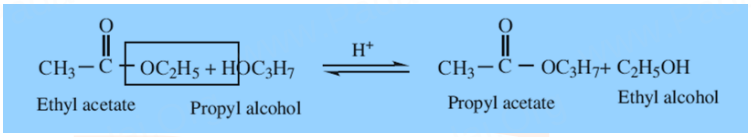
11. Hell – Volhard – Zelinsky reaction (HVZ reaction)

Carboxylic acids having an α - hydrogen are halogenated at the α - position on treatment with chlorine or bromine in the presence of small amount of red phsosphorus to form α halo carboxylic acids.



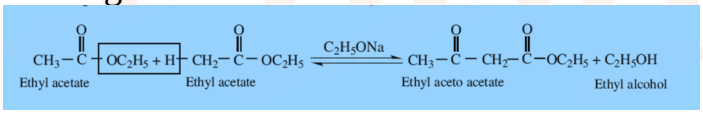
12. Transesterification

Esters of an alcohol can react with another alcohol in the presence of a mineral acid to give the ester of second alcohol. The interchange of alcohol portions of the esters is termed transesterification



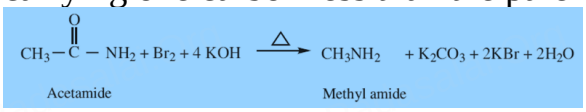
13. Claisen Condensation

Esters containing at least one ∝- hydrogen atom undergo self condensation in the presence of a strong base such as sodium ethoxide to form b- keto ester.



14. Hoff mann's degradation

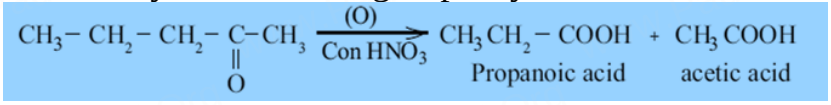
Amides reacts with bromine in the presence of caustic alkali to form a primary amine carrying one carbon less than the parent amide.



Short answers

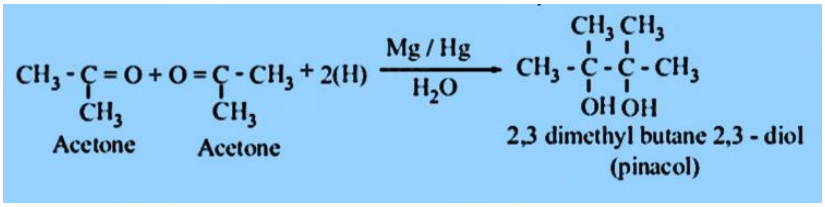
1.Define Popoff's rule.

It states that during the oxidation of an unsymmetrical ketone, a (C–CO) bond is cleaved in such a way that the keto group stays with the smaller alkyl group.



2.How will you prepare symmetrical diols or pinacol.

Ketones, on reduction with magnesium amalgam and water, are reduced to symmetrical diols known as pinacol.



3.What is glacial acetic acid and how will you prepare it ?

- Vinegar is 6 to 8% solution of acetic acid in water. Pure acetic acid is called glacial acetic acid.Because it forms ice like crystal when cooled.
- When aqueous acetic acid is cooled at 289.5 K, acetic acid solidifies and forms ice like crystals, where as water remains in liquid state and removed by filtration.
- This process is repeated to obtain glacial acetic acid.

4.What are the test for carboxylic acid ?

- Carboxylic acids decompose carbonates and bicarbonates evolving carbondioxide gas with effervescence.
- All Carboxylic acids turn blue litmus red
- When carboxylic acid is warmed with alcohol and Con H_2SO_4 it forms an ester, which is detected by its fruity odour.

5. Methods of preparation of esters

1. Esterification

Treatment of alcohols with carboxylic acids in presence of mineral acid gives esters. The reaction is carried to completion by using an excess of reactant or by removing the water from the reaction mixture.

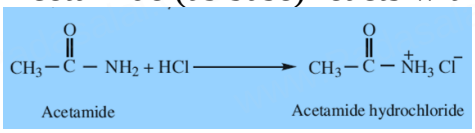
2. Alcoholysis of Acid chloride or Acid anhydrides

Treatment of acid chloride or acid anhydride with alcohol also gives esters

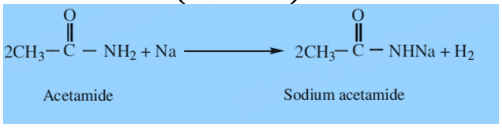
6. Prove that amide shows Amphoteric character

Amides behave both as weak acid as well as weak base and thus show amphoteric character. This can be proved by the following reactions.

Acetamide (as base) reacts with hydrochloric acid to form salt



Acetamide (as acid) reacts with sodium to form sodium salt and hydrogen gas is liberated



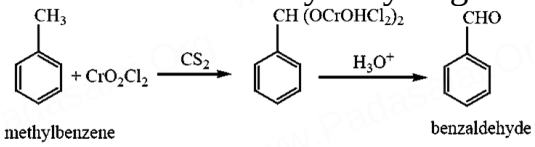
Long answers

1.How will you prepare benzaldehyde from toluene , benzene

From toluene

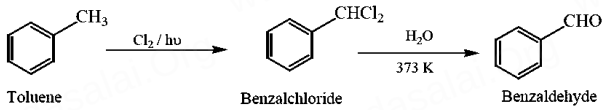
(i)Using chromyl chloride

When chromylchloride is used as an oxidising agent, toluene gives benzaldehyde. This reaction is called Etard reaction. Oxidation of toluene by chromic oxide gives benzylidine diacetate which on hydrolysis gives benzaldehyde.



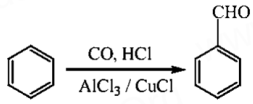
(ii) Chlorination of toluene

Side chain chlorination of toluene gives benzal chloride, which on hydrolysis gives benzaldehyde.

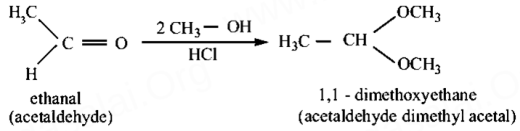


Gattermann – Koch reaction

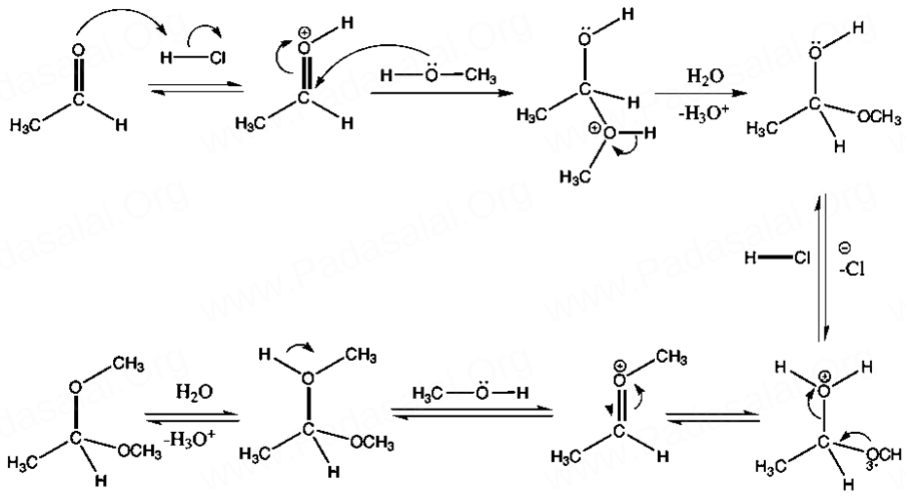
This reaction is a variant of Friedel – Crafts acylation reaction. In this method, reaction of carbon monoxide and HCl generate an intermediate which reacts like formyl chloride



2.How will you prepare 1,1, - dimethoxy ethane from acetaldehyde with mechanism



Mechanism



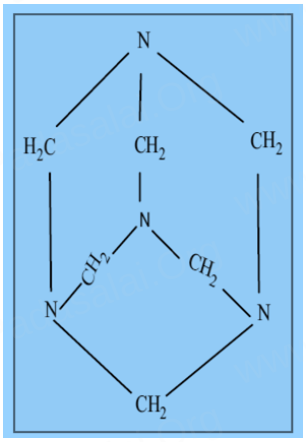
3.How will you prepare urotropine . Write down its structure and use

Formaldehyde reacts with ammonia to form hexa methylene tetramine, which is also known as Urotropine.

$6CH_2O + 4NH_3 \rightarrow (CH_2)_6N_4 + 4H_2O$

Hexamethylene tetramine

Structure

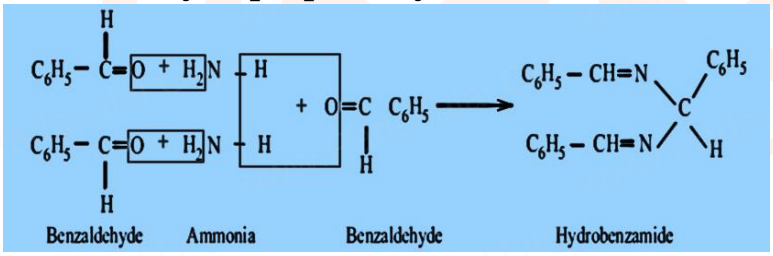


Uses

(i) Urotropine is used as a medicine to treat urinary infection.

(ii) Nitration of Urotropine under controlled condition gives an explosive RDX (Research and development explosive). It is also called cyclonite or cyclotri methylene trinitramine.

4.How will you prepare Hydrobenzamide from benzaldehyde



5.Explain Cannizaro reaction with mechanism or what happens when benzaldehyde is heated with concentrated NaoH

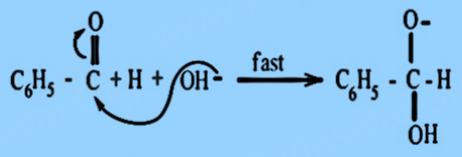
In the presence of concentrated aqueous or alcoholic alkali, aldehydes which do not have α - hydrogen atom under of self oxidation and reduction (disproportionation) to give a mixture of alcohol and a salt of carboxylic acid. This reaction is called Cannizaro reaction. Benzaldehyde on treatment with concentrated NaOH (50%) gives benzyl alcohol and sodium benzoate.

$$\underset{\text{Benzaldehyde}}{C_6H_5CHO} + \underset{}{C_6H_5CHO} \xrightarrow{50\%\ NaOH} \underset{\text{Benzoic acid}}{C_6H_5COOH} + \underset{\text{Benzyl alcohol}}{C_6H_5CH_2OH}$$

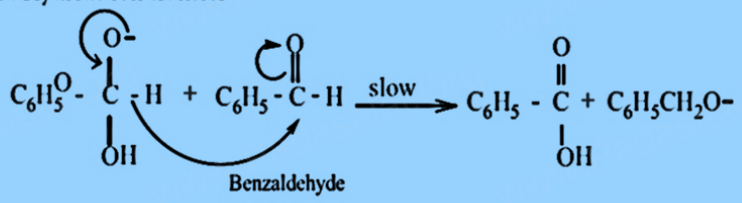
Mechanism of Cannizaro reaction

Cannizaro reaction involves three steps.

Step 1 : Attack of OH^- on the carbonyl carbons.

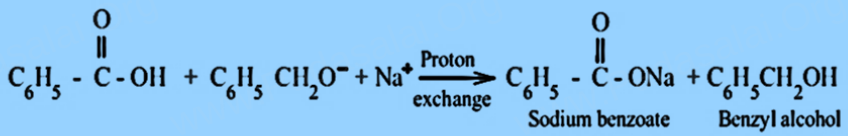


Step 2 : Hydride ion transfer



Benzaldehyde

Step 3 : Acid – base reaction.



Sodium benzoate Benzyl alcohol

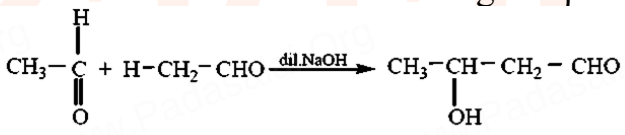
Cannizaro reaction is a characteristic of aldehyde having no α – hydrogen.

6.Explain Aldol condensation with mechanism

In presence of dilute base NaOH, or KOH, two molecules of an aldehyde or ketone having α - hydrogen add together to give β- hydroxyl aldehyde (aldol) or β - hydroxyl ketone (ketol). The reaction is called aldol condensation reaction.

The aldol or ketol readily loses water to give α,β – unsaturated compounds which are aldol condensation products.

Acetaldehyde when warmed with dil NaOH gives β - hydroxyl butraldehyde (acetaldol)



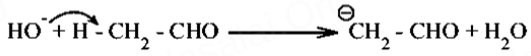
Acetaldehyde Acetaldol (3 - Hydroxy butanal)

Mechanism

The mechanism of aldol condensation of acetaldehyde takes place in three steps.

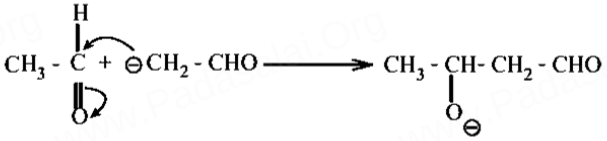
Step 1 :

The carbanion is formed as the α - **hydrogen atom** is removed as a proton by the base.



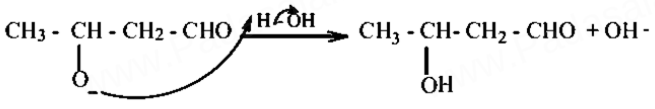
Step 2 :

The carbanion attacks the carbonyl carbon of another unionized aldehyde to form an alkoxide ion.



Step 3 :

The alkoxide ion formed is protonated by water to form aldol.



3-Hydroxy butanal

7. Explain the Test for Aldehydes

i) Tollens Reagent Test

Tollens reagent is an ammonical silver nitrate solution. When an aldehyde is warmed with Tollens reagent a bright silver mirror is produced due to the formation of silver metal. This reaction is also called silver mirror test for aldehydes.

$$CH_3CHO + 2\,[Ag(NH_3)_2]^+ + 3OH^- \rightarrow CH_3COO^- + 4NH_3 + 2Ag + 2H_2O$$

ii) Fehlings solution Test

- Fehlings solution is prepared by mixing equal volumes of Fehlings solution 'A'containing aqueous copper sulphate and Fehlings solution 'B' containing alkaline solution of sodium potassium tartarate (Rochelle salt)
- When aldehyde is warmed with Fehlings solution deep blue colour solution is changed to red precipitate of cuprous oxide.

$$CH_3CHO + 2Cu^{2+} + 5OH^- \rightarrow CH_3COO^- + Cu_2O\downarrow + 3H_2O$$

(blue) (red)

iii) Benedict's solution Test:

Benedicts solution is a mixture of $CuSO_4$ + sodium citrate + NaOH. Cu^{2+} is reduced by aldehyde to give red precipitate of cuprous oxide.

$$CH_3CHO + 2Cu^{2+} + 5OH^- \rightarrow CH_3COO^- + Cu_2O\downarrow + 3H_2O$$

(blue) (red)

iv) Schiffs' reagent Test

Dilute solution of aldehydes when added to schiffs' reagent (Rosaniline hydrochloride dissolved in water and its red colour decolourised by passing SO2) yields its red colour. This is known as Schiffs' test for aldehydes . Ketones do not give this test. Acetone however gives a positive test but slowly.

8.Uses

Formaldehyde

(i) 40% aqueous solution of formaldehyde is called formalin. It is used for preserving biological specimes.

(ii) Formalin has hardening effect, hence it is used for tanning.

(iii) Formalin is used in the production of thermo setting plastic known as bakelite, which is obtained by heating phenol with formalin.

Urotropine

(i) Urotropine is used as a medicine to treat urinary infection.

(ii) Nitration of Urotropine under controlled condition gives an explosive RDX (Research and development explosive). It is also called cyclonite or cyclotri methylene trinitramine.

Acetaldehyde

(i) Acetaldehyde is used for silvering of mirrors

(ii) Paraldehyde is used in medicine as a hypnotic.

(iii) Acetaldehyde is used in the commercial preparation of number of organic compounds like acetic acid, ethyl acetate etc.,

Acetone

(i) Acetone is used as a solvent, in the manufacture of smokeless powder (cordite)
(ii) It is used as a nail polish remover.
(iii) It is used in the preparation of sulphonal, a hypnotic.
(iv) It is used in the manufacture of thermosoftening plastic Perspex.

Benzaldehyde is used

(i) as a flavoring agent
(ii) in perfumes
(iii) in dye intermediates
(iv) as starting material for the synthesis of several other organic compounds like cinnamaldehyde, cinnamic acid, benzoyl chloride etc.

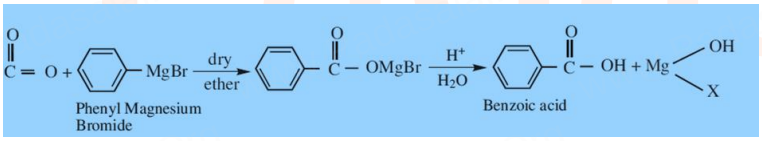
Aromatic Ketones

(i) Acetophenone has been used in perfumery and as a hypnotic under the name hyphone.
(ii) Benzophenone is used in perfumery and in the preparation of benzhydrol drop.

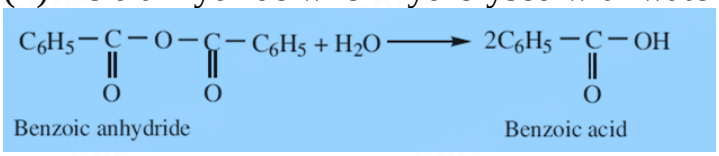
9.How will you prepare Benzoic acid from i)Grignard reagent ii)Acid anhydride iii) Alkyl benzenes

(i).From Grignard reagent

Grignard reagent reacts with carbon di oxide (dry ice) to form salts of carboxylic acid which in turn give corresponding carboxylic acid after acidification with mineral acid.

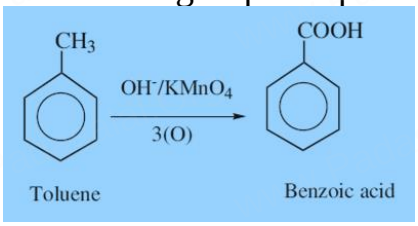


(ii) Acid anhydride when hydrolysed with water give corresponding carboxylic acids.



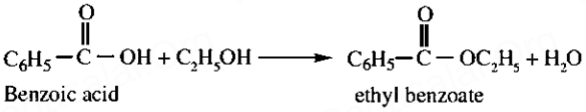
(iii) From Alkyl benzenes

Aromatic carboxylic acids can be prepared by vigorous oxidation of alkyl benzene with chromic acid or acidic or alkaline potassium permanganate. The entire side chain is oxidised to –COOH group irrespective of the length of the side chain.



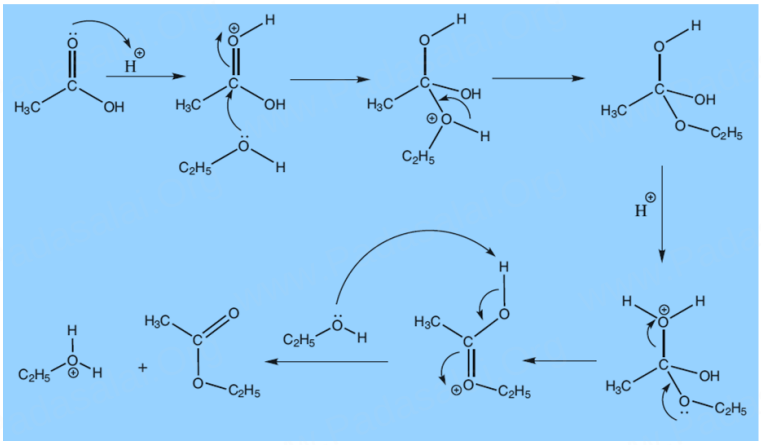
10. Explain about Esterification reaction with mechanism

When carboxylic acids are heated with alcohols in the presence of conc. H_2SO_4 or dry HCl gas, esters are formed. The reaction is reversible and is called esterification.



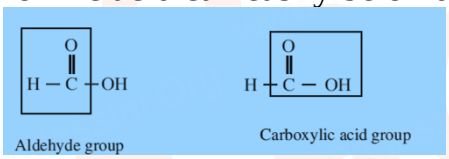
Mechanism of esterification

The Mechanism of esterification involves the following steps.



11.Prove that formic acid is strong reducing agent

Formic acid contains both an aldehyde as well as an acid group. Hence, like other aldehydes, formic acid can easily be oxidised and therefore acts as a strong reducing agent



i) Formic acid reduces Tollens reagent (ammonical silver nitrate solution) to metallic silver.

$$HCOO^- + 2Ag^+ + 3OH^- \rightarrow 2Ag + CO_3^{2-} + 2H_2O$$

(Tollens reagent) Silver mirror

ii) Formic acid reduces Fehlings solution. It reduces blue coloured cupric ions to red coloured cuprous ions.

$$HCOO^- + 2Cu^{2+} + 5\,OH^- \rightarrow Cu_2O + CO_3^{2-} + 3\,H_2O$$

(Fehlings solution) red precipitate

12.Uses of carboxylic acid

a) Formic acid

It is used

i) for the dehydration of hides.

ii) as a coagulating agent for rubber latex

iii) in medicine for treatment of gout

iv) as an antiseptic in the preservation of fruit juice.

b) Acetic acid

It is used

i) as table vinegar
ii) for coagulating rubber latex
iii) for manufacture of cellulose acetate and poly vinylacetate

c) Benzoic acid

It is used
i) as food preservative either in the pure form or in the form of sodium benzoate
ii) in medicine as an urinary antiseptic
iii) for manufacture of dyes

Acetyl Chloride

It is used
i) as acetylating agent in organic synthesis
ii) in detection and estimation of – OH, - NH_2 groups in organic compounds

Acetic anhydride

It is used
i) acetylating agent
ii) in the preparation of medicine like asprin and phenacetin
iii) for the manufacture plastics like cellulose acetate and poly vinyl acetate.

Ethyl acetate is used

i) in the preparation of artificial fruit essences.
ii) as a solvent for lacquers.
iii) in the preparation of organic synthetic reagent like ethyl acetoacetate

Knowledge based question

1. Which of the following compounds would undergo aldol condensation, which the Cannizzaro reaction and which neither?

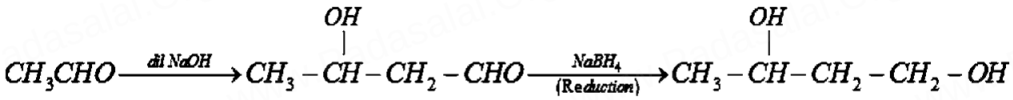
(i) Methanal
(ii) 2-Methylpentanal
(iii) Benzaldehyde
(iv) Benzophenone
(v) Cyclohexanone
(vi) 1-Phenylpropanone
(vii) Phenylacetaldehyde
(viii) Butan-1-ol
(ix) 2, 2-Dimethylbutanal

- Aldehydes and ketones having at least one α-hydrogen undergo aldol condensation.
- The compounds (ii) 2−methylpentanal, (v) cyclohexanone, (vi) 1-phenylpropanone, and (vii)phenylacetaldehyde contain one or more α-hydrogen atoms. Therefore, these undergo aldol condensation.
- Aldehydes having no α-hydrogen atoms undergo Cannizzaro reactions.

- The compounds (i)Methanal,(iii) Benzaldehyde, and (ix) 2, 2-dimethylbutanal do not have any α- hydrogen.
- Therefore, these undergo cannizzaro reactions.
- Compound (iv) Benzophenone is a ketone having no α-hydrogen atom and compound (viii) Butan-1-ol is an alcohol. Hence, these compounds do not undergo either aldol condensation or cannizzaro reactions.

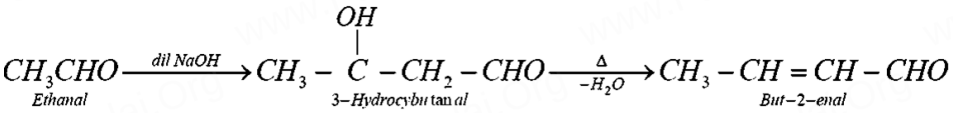
2. How will you convert ethanal into the following compounds?
(i) Butane-1, 3-diol (ii) But-2-enal (iii) But-2-enoic acid

(i) On treatment with dilute alkali, ethanal produces 3-hydroxybutanal gives butane-1, 3-diol on reduction.



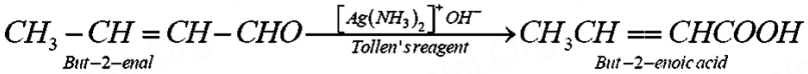
Ethanal 3-Hydroxybutanal Butane-1,3-diol

(ii) On treatment with dilute alkali, ethanal gives 3-hydroxybutanal which on heating produces but-2-enal.



Ethanal 3–Hydrocybutanal But–2–enal

(iii) When treated with Tollen's reagent, But-2-enal produced in the above reaction produces but-2-enoic acid.



But–2–enal But–2–enoic acid

3. Arrange the following compounds in increasing order of their property as indicated:
(i) Acetaldehyde, Acetone, Di-*tert*-butyl ketone, Methyl *tert*-butyl ketone (reactivity towards
HCN)
(ii) $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$, $(CH_3)_2CHCOOH$, $CH_3CH_2CH_2COOH$(acid strength)
(iii) Benzoic acid, 4-Nitrobenzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)

(i). When HCN reacts with a compound, the attacking species is a nucleophile, Therefore, as the negative charge on the compound increases, its reactivity with HCN decreases. In the given compounds, the +I effect increases as shown below. It can be observed that steric hindrance also increases in the same
Di-*tert*-butyl ketone < Methyl *tert*-butyl ketone < Acetone < Acetaldehyde

(ii) Groups having +I effect will decrease the strength of the acids and groups having −I effect will increase the strength of the acids.
$(CH_3)_2CHCOOH$ < $CH_3CH_2CH_2COOH$<, $CH_3CH(Br)CH_2COOH$< $CH_3CH_2CH(Br)COOH$

(iii). Electron-donating groups decrease the strengths of acids, while electron-withdrawing groups increase the strengths of acids. As methoxy group is an electron-donating group, 4-methoxybenzoic acid is a weaker acid than benzoic acid. Nitro group is an electron-withdrawing group and will increase the strengths of acids. As 3,4- dinitrobenzoic acid contains two nitro groups, it is a slightly stronger acid than 4-nitrobenzoic acid. Hence, the strengths of the given acids increase as

4-Methoxybenzoic acid < Benzoic acid < 4-Nitrobenzoic acid < 3,4-Dinitrobenzoic acid

4. Give simple chemical tests to distinguish between the following pairs of compounds.
(i) Propanal and Propanone
(ii) Ethanal and Propanal
(iii) Benzaldehyde and Acetophenone
(iv) Benzoic acid and Ethyl benzoate
(v) Pentan-2-one and Pentan-3-one

(i) Propanal is an aldehyde. Thus, it reduces Tollen's reagent. But, propanone being a ketone does not reduce Tollen's reagent.

(ii) Aldehydes and ketones having at least one methyl group linked to the carbonyl carbon atom responds to the iodoform test. Ethanal having one methyl group linked to the carbonyl carbon atom responds to this test. But propanal does not have a methyl group linked to the carbonyl carbon atom and thus, it does not respond to this state.

(iii) Aldehydes respond to Tollen's test. Benzaldehyde being an aldehyde reduces Tollen's reagent to give a red-brown precipitate of Cu_2O, but acetophenone being a ketone does not.

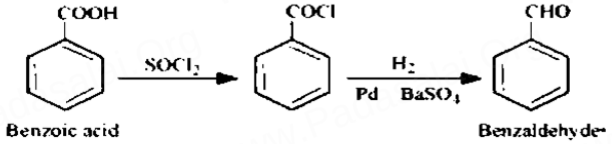
(iv) Acids react with $NaHCO_3$ (sodium carbpnate) to produce brisk effervescence due to the evolution of CO_2 gas.
Benzoic acid being an acid responds to this test, but ethylbenzoate does not.

(v) Pentan-2-one is a methyl ketone. Thus, it responds to iodoform test. But pentan-3-one not being a methyl ketone does not respond to this test.

5. How will you bring about the following conversions in not more than two steps?
(i) Propanone to Propene
(ii) Benzoic acid to Benzaldehyde
(iii) Ethanol to 3-Hydroxybutanal
(iv) Benzene to *m*-Nitroacetophenone
(v) Benzaldehyde to Benzophenone
(vi) Bromobenzene to 1-Phenylethanol
(vii) Benzaldehyde to 3-Phenylpropan-1-ol
(viii) Benazaldehyde to α-Hydroxyphenylacetic acid
(ix) Benzoic acid to *m*- Nitrobenzyl alcohol

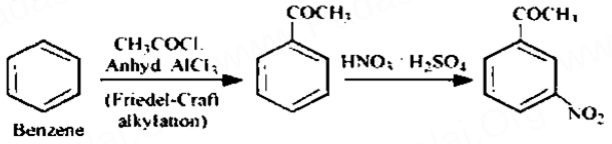
(i) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow{NaBH_4} CH_3-\underset{OH}{\underset{|}{CH}}-CH_3 \xrightarrow[\Delta]{conc.H_2SO_4} CH_3-CH=CH_2$ (Propene)

(ii)



(iii) $CH_3-CH_2-OH \xrightarrow{CrO_3} CH_3CHO \xrightarrow[(Aldol\ condensation)]{dil.NaOH} CH_3-\underset{OH}{\underset{|}{C}}H-CH_2CHO$ (Ethanol; 3-hydroxybutanal)

(iv)



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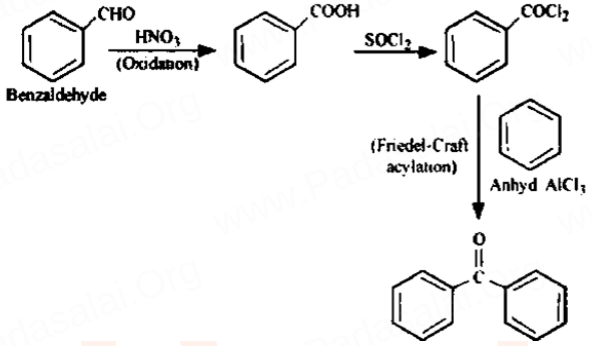

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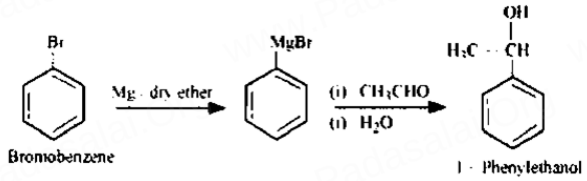

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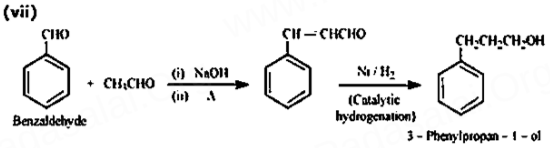
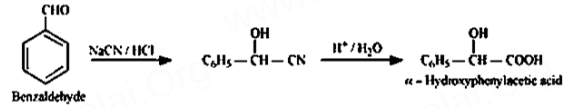


(viii)



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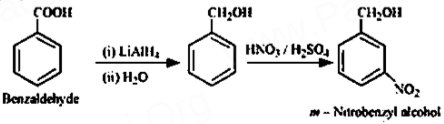


6. Give plausible explanation for each of the following:

(i) Cyclohexanone forms cyanohydrin in good yield but 2, 2, 6- trimethylcyclohexanone does not.

(ii) During the preparation of esters from a carboxylic acid and an alcohol in the presence of an acid catalyst, the water or the ester should be removed as soon as it is formed.

(i) .In cyclohexane the nucleophile CN^- can easily attack without any steric hindrance. However, in the case of 2, 2, 6- trimethylcyclohexanone, methyl groups at α-positions offer steric hindrances and as a result,CN^- cannot attack effectively.

(ii) Ester along with water is formed reversibly from a carboxylic acid and an alcohol in presence of an acid.
If either water or ester is not removed as soon as it is formed, then it reacts to give back the reactants as the reaction is reversible. Therefore, to shift the equilibrium in the forward direction i.e., to produce more ester, either of the two should be removed

7. Arrange the following compounds in increasing order of their reactivity in nucleophilic addition reactions. (Ethanal, Propanal, Propanone, Butanone.

The electron density at the carbonyl carbon increases with the increase in the +I effect. As a result, the chances of attack by a nucleophile decrease. Hence, the increasing order of the reactivities of the given carbonyl compounds in nucleophilic addition reactions is:
Butanone <Propanone<Propanal<Ethanal.

Problems

1. Compound (A) of molecular formula C_2H_4O reduce Tollen's reagents.(A) on treatment with HCN gives compound (B).Compound (B) on hydrolysis with acid compound (C) with molecular formula $C_3H_6O_3$ which an optically active compound. Compound (A) on reduction with N_2H_4/C_2H_5ONa gives a hydrocarbon (D) of molecular formula C_2H_6.Identify A,B,C, and D. Explain thereaction.

$$\underset{(A)}{CH_3CHO} + HCN \rightarrow \underset{(B)}{CH_3CH(OH)CN} \longrightarrow \underset{(C)}{CH_3CH(OH)COOH}$$

$$\underset{(A)}{CH_3CHO} \xrightarrow[4(H)]{N_2H_4/C_2H_5ONa} \underset{(D)}{CH_3CH_3} + N_2 + H_2O$$

Compound	Name
A	Acetaldehyde
B	Acetaldehyde cyanohydrin
C	Lactic acid
D	Ethane

2.An organic compound (A) of molecular formula C_3H_6O on reduction with $LiAlH_4$ gives (B). Compound (B) gives blue colour in Victor Meyer's test and also form a Chloride (C) with $SOCl_2$.The Chloride on treatment with alcoholic KOH gives (D). Identify the compounds A,B,C and D. Explain the reactions.

$$CH_3COCH_3 \xrightarrow{LIALH_4} (CH_3)_2\,CHOH$$
(B)

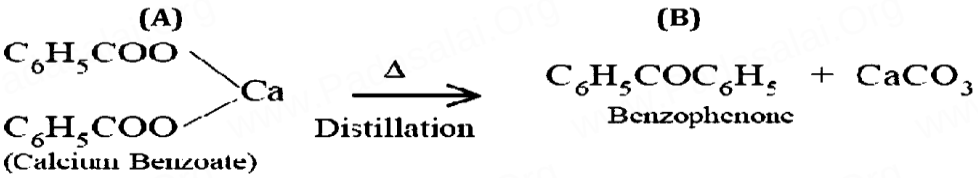
$$(CH_3)_2\,CHOH + SOCl_2 \longrightarrow (CH_3)_2\,CHCl + SO_2 + HCl$$
(B) (C)

$$(CH_3)2\,CHCl \xrightarrow{Alc.KOH} CH_3C{=}CH_2 + KCl + H_2O$$
(B) (D)

Compound	Name
A	Acetone
B	2-Propanol
C	Isopropyl chloride
D	Propene

3. Compound (A) of molecular formula C_7H_6O reduce Tollen's reagent and also gives Cannizzaro reaction. (A) on oxidation gives compound (B) with molecular formula $C_7H_6O_2$. Calcium salt of (B) on dry distillation gives compound (C) with molecular formula $C_{13}H_{10}O$ Identify A,B, and C. Explain the reaction.

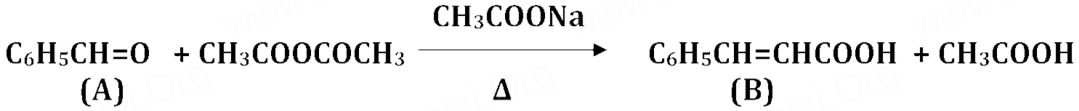
$$C_6H_5CHO \xrightarrow[\text{alkaline } KMnO_4]{(O)} C_6H_5COOH$$
(A) (B)

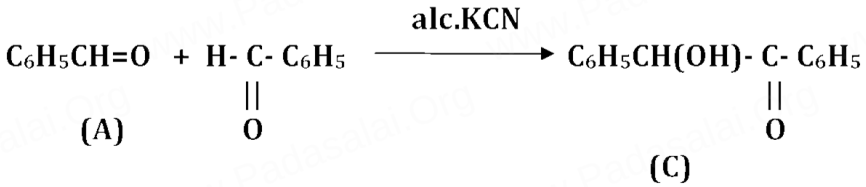


Compound	Name
A	Benzaldehyde
B	Benzoic acid
C	Benzo phenone

4. An aromatic aldehyde (A) of molecular formula C_7H_6O which has the smell of bitter almonds on treatment with $(CH_3CO)_2O$ and CH_3COONa to give compound

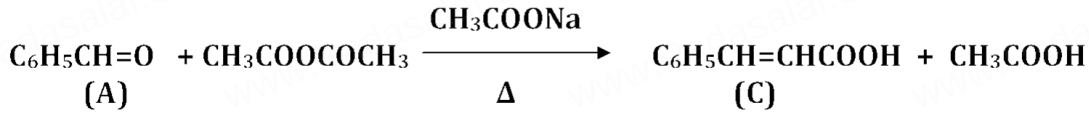
(B) which is an aromatic unsaturated acid. (A) also react with (A) in the presence of alc. KCN to give dimer (C).Identify A,B, and C. Explain the reactions





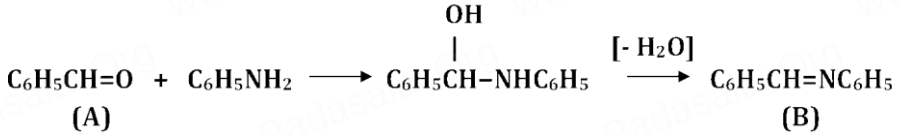
Compound	Name
A	Benzaldehyde
B	Bezoin
C	Cinnamic acid

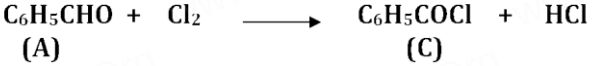
5. An organic compounds (A) C7H6O when treated alcoholic KCN forms (B) ($C_{14}H_{12}O_2$) and (A) on refluxing with sodium acetate and acetic anhydride forms an acid (C) ($C_9H_8O_2$).Identify A,B and C. Explain the reaction.



Compound	Name
A	Benzaldehyde
B	Cinnamic acid
C	Benzoin

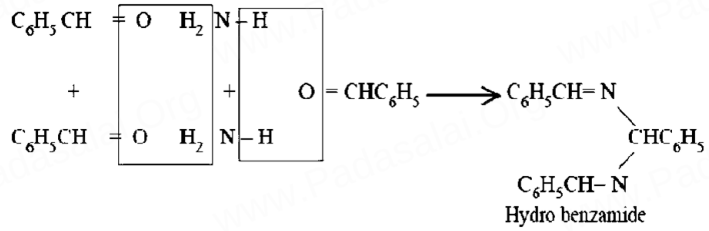
6. An organic compound (A) of molecular formula C_7H_6O is not reduced by Fehling's solution but will undergoes Cannizzaro reaction. Compound (A)react with Aniline to give compound (B) .Compound (A) also react with Cl_2 in the absence of catalyst to give compound (C).Identify A,B and C. Explain the reaction.

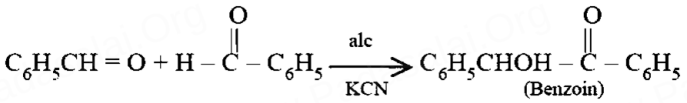


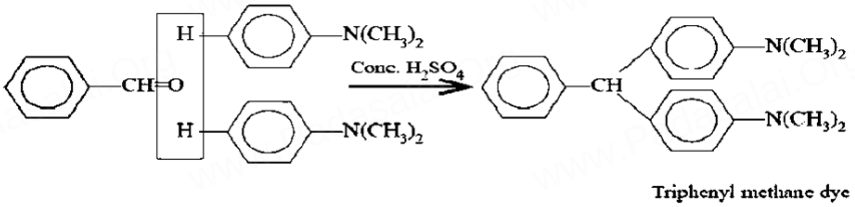


Compound	Name
A	Benzaldehyde
B	Schiff's base
C	Benzoyl chloride

7. An organic compound A (C_7H_6O) has bitter almond smell, with ammonia 'A' gives 'B' ($C_{21}H_{18}N_2$) with aqueous alcoholic KCN 'A' gives 'C' ($C_{14}H_{12}O2$). With aromatic tertiary amine 'A' gives 'D' ($C_{23}H_{26}N_2$). What are A, B, C and D explain the reaction.

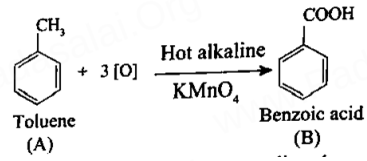


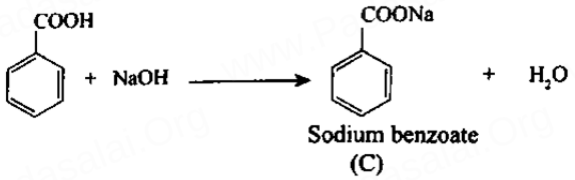


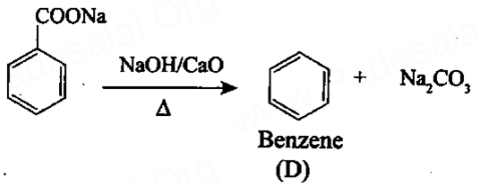


Compound	Name
A	Benzaldehyde
B	Hydrobenzamide
C	Benzoin
D	Triphenyl methane dye or malachite dye

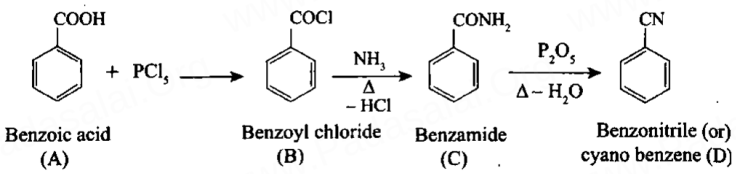
8.An organic compound (A) of molecular formula C_7H_8 on reaction with hot alkaline $KMnO_4$ gives (B) of molecular formula $C_7H_6O_2$ which gives brisk effervescence with $NaHCO_3$ solution . (B) on reaction with sodium hydroxide gives C of formula $C_7H_5O_2Na$ .Compound (C) on treatment with sodalime gives (D) the simplest hydrocarbon







9. An organic compound (A) of molecular formula $C_7H_60_2$ on reaction with PCl_5 gives (B) of molecular formula C_7H_5OCl. (B) on reaction with ammonia gives C of formula C_7H_7NO .Compound (C) on treatment with P_2O_5 gives (D)



10. An organic compound (A) of molecular formula $C_2H_4O_2$ on reaction PCl_5 gives (B) of molecular formula C_2H_3OCl. (B) on reaction with ammonia gives C of formula C_2H_5NO .Compound (C) on treatment with Br_2 & KOH gives

$CH_3COOH + PCl_5 \longrightarrow CH_3COCl + POCl_3 + HCl$

Acetic acid (A) Acetyl chloride(B)

$CH_3COCl + NH_3 \longrightarrow CH_3CONH_2 + HCl$

Acetamide (C)

$CH_3CONH_2 + Br_2 + 4KOH \longrightarrow CH_3NH_2 + K_2CO_3 + 2KBr + H_2O$

Methyl amine (D)

UNIT – 13 ORGANIC NITROGEN COMPOUNDS

STUDY MATERIAL

UNIT -13 ORGANIC NITROGEN COMPOUNDS

One marks (Book inside)

1. Which of the following is needed to maintain the health of nerves, skin and red blood cells?
a) Vitamin B_{12} **b) Vitamin B_6**
c) Vitamin B_1 d) Vitamin C

2. Which one of the following is needed to maintain the health of nerves and skin?
a) Pyridoxine b) Cobalamine
c) Dopamine d) Histamine

3. Which one of the following is act as neurotransmitter?
a) Pyridoxine b) Histamine
c) Dopamine d) Cyano cobalamine

4. Which one of the following dilates blood vessels?
a) Histamine b) Streptomycin
c) Penicillin d) Dopamine

5. 1–nitrobutane and 2–methyl–1– nitropropane are belong to _____.
a) position isomerism b) functional isomerism
c) tautomerism **d) chain isomerism**

6. Which of the following pair shows functional isomerism?
a) 1-nitro butane and 2-nitro butane
b) 1-nitro butane and butyl nitrite
c) 1- nitro butane and 2- methyl -1-nitropropane
d) 2- nitro butane and 2- methyl -2-nitropropane

7. Nitro methane and methyl nitrite are the examples of _____
a) Position isomerism b) chain isomerism
c) metamerism **d) Tautomerism**

8. Which one of the following does not exhibit tautomerism?
a) 1-nitro ethane b) Nitro methane
c) methyl nitrite **d) 2-methyl-2-nitro propane**

9. What is the product formed when α – chloro acetic acid is boiled with aqueous solution of sodium nitrite?
a) nitro ethane **b) nitro methane**
c) Acetamide d) α – chloro acetamide

10. The reagent used in the conversion of acetaldoxime to nitro ethane (1˚) is _____.
a) aqueous $KMnO_4$ b) **trifluoro peroxy acetic acid**
c) alcoholic KOH d) conc. HNO_3

11. Which of the following is called oil of mirbane?
a) Nitro methane b) nitro propane **c) Nitro benzene** d) nitro ethane

12. Amino group can be directly converted into nitro group by_____.
a) Caro's acid b) Fuming mixture of conc.HNO_3 + conc.H_2SO_4
c) $NaNO_2$+HCl d) Ethanolic KNO_2

13. Which of the following does not react with conc.HCl?

a) Nitro ethane **b) 2-methyl-2-nitropropane** c) 2-nitro propane d) Aniline

14. Which one of the following is formed when nitrobenzene is treated with conc.HNO_3 in H_2SO_4 473 K?

a) 1,2 – dinitro benzene b) 1,4 – dinitro benzene

c) 1,3 –dinitro benzene **d) 1,3,5 - trinitro benzene**

15. What will be the product formed when 1,3,5 – trinitro toluene is treated with acidified $Na_2Cr_2O_7$ and sodalime?

a) TNB b) TNT c) TNG d) GTN

16. What is the C – N – C bond angle of trimethylamine?

a) 109˚.5’ b) 107˚ **c) 108˚** d) 108˚.31’

17. Which one of the reaction is used in the synthesis of aliphatic primary amines?

a) Hoffmann ammonolysis b) Rosenmund’s reduction

c) Gattermann synthesis **d) Gabriel phthalimide synthesis**

18. The conversion of ethanol into all types of amines by the action of ammonia along with Alumina is _____.

a) HVZ reaction

b) Sabatier - mailhe method

c) Carbylamine reaction

d) Mendius reaction

19. The correct order of basic strength in the case of alkyl substituted amines is_____.

a) $(CH_3)_2NH > CH_3\text{-}NH_2 > (CH_3)_3N > NH_3$

b) $NH_3 > (CH_3)_3\text{-}N > CH_3NH_2 > (CH_3)_2NH$

c) $(CH_3)_3N < CH_3\text{-}NH_2 > NH_3 < (CH_3)_2NH$

d) $(CH_3)_2NH_2 < (CH_3)\text{-}N < NH_3 > (CH_3)_2NH$

20. The relative basicity of amine follows the order as_____.

a) Alkyl amines > Aralkyl amines > Ammonia > N-aralklamine > Arylamine.

b) Aralkyl amines > Ammonia > Arylamine > Alkyl amines > N-aralklamine.

c) Arylamine < Alkyl amines > Aralkyl amine < Ammonia > N-aralklamine

d) N-aralklamine < Arylamine < Ammonia < Alkyl amine < Aralkyl amine

21. The reaction of aniline with nitrous acid at low temperature is known as _____.

a) Carbylamine reaction b) mustard oil reaction

c) Diazotisation d) Sand meyer’s reaction

22. The conversion of benzene diazonium chloride into chlorobenzene is known as

a) Gabriel phthalimide synthesis

b) Carbylamine reaction

c) Sand meyer reaction

d) Coupling reaction

23. In the Hoffmann bromamide degradation reaction, the number of moles of KOH and Br_2 used per moles of amine produced are _____.

a) four moles of KOH and two moles of Br_2

b) two moles of KOH and two moles of Br_2

c) four moles of KOH and one mole of Br_2

d) one mole of KOH and one mole of Br_2

24. Replacement of diazonium group by fluorine is known as _____.

a) Gattermann reaction b) Sand meyer reaction

c) Baltz-Schiemann reaction d) Comberg reaction

25. Liebermann's nitroso reaction is used for testing _____.

a) 1˚ amine **b) 2˚ amine** c) 3˚ amine d) all the above

26. A positive carbylamines test is given by _____.

a) N,N – dimethyl aniline **b) 2,4 - dimethyl aniline**

c) N – methyl – O – methyl aniline d) p – methyl benzylamine

27. Carbylamine test is used in the detection of _____.

a) aliphatic 2˚ amine b) aromatic 1˚ amine

c) aliphatic 1˚ amine **d) both aliphatic and aromatic 1˚ amine**

28. The reaction between benzene diazonium chloride and benzene in presence of NaOH is_____.

a) Perkin's reaction. b) Gattermann's reaction

c) Sandmeyer reaction **d) Gomberg-Bachmann reaction**

29. Nitro – acinitro tautomerism is exhibited by _____.

a) nitro methane b) nitro benzene c) chloropicrin d) o-toluidine

30. Aniline react with benzoyl chloride in the presence of sodium hydroxide and gives benzanilide. This reaction is known as_____.

a) Gattermann's reaction b) Sandmeyer reaction

c) Schotten – Baumann reaction d) Gomberg-Bachmann reaction

31. Chloropicrin (CCl_3NO_2) is used as

a) dyes b) pharmaceuticals c) explosives **d) soil sterilizing agents**

32. The basic character of amines is due to the

a) tetrahedral structure b) presence of nitrogen atom

c) lone pair of electron on nitrogen atom d) high electronegativity of nitrogen

33. Which gives an yellow oil with nitrous acid

a) 1˚ amine **b) 2˚ amine** c) 3˚ amine d) quarternary salt

34. Electrophile used in the nitration of benzene is_____.

a) Hydronium ion b) sulphonic acid **c) nitronium ion** d) bromide ion

35. Bromo ethane reacts with silver nitrite to give

a) $C_2H_5NO_2$ b) C_2H_5-O-NO c) C_2H_5Ag + NaBr d) C_2H_5NC

36. When nitromethane is reduced with Zn dust + NH_4Cl in neutral medium, we get

a) CH_3NH_2 b) $C_2H_5NH_2$ **c) CH_3NHOH** d) C_2H_5COOH

37. The compound that is most reactive towards electrophilic nitration is

a) Toluene b) benzene c) benzoic acid d) nitrobenzene

38. Nitration of nitrobenzene results in

a) o-dinitro benzene b) 1,3,5-trinitro benzene

c) p-dinitro benzene **d) m-dinitro benzene**

39. Electrophile used in the nitration of benzene is

a) hydronium ion b) sulphonic acid **c) nitronium ion** d) bromide ion

40. The reduction of $CH_3 – CH_2 – C \equiv N$ with sodium and alchol results In the formation of
a) CH_3-$CH(NH_2)$-CH_3 b) $CH_3CH_2CH_2$ OH + N_2
c) $CH_3CH_2CH_2NH_2$ d) $CH_3CH_2NH_2$

41. The basic character of amines is due to the
a) tetrahedral structure
b) presence of nitrogen atom
c) lone pair of electrons on nitrogen atom
d) high electronegativity of nitrogen

42. Primary amine acts as
a) Electrophile **b) Lewis base** c) Lewis acid d) Free radical

43. Which one of the following is a secondary amine?
a) aniline **b) diphenyl amine** c) sec.butylamine d) tert.butylamine

44. $C_6H_5NH_2$ is treated with NaNO2 / HCl it forms X.Identify X.
a) C_6H_5Cl b) C_6H_5NHOH **c) $C_6H_5N_2Cl$** d) C_6H_5OH

45. Which of the following will not undergo diazotization?
a) m-toluidine b) aniline c) p-amino phenol **d) benzyl amine**

46. Aniline differs from ethylamine by the reaction with
a) metallic sodium b) an alkyl halide
c) chloroform and caustic potash **d) nitrous acid**

47. Which of the following reagent cannot be used for the conversation of nitrobenzene to aniline
a) Sn / HCl b) $LiAlH_4$ c) H_2/Ni **d) Zn / NaOH**

48. The reaction between a primary amine, chloroform and alcoholic KOH is known as
a) Sandmeyer reaction b) Hoffmann's reaction
c) Wurtz reaction **d) Carbylamine reaction**

49. When aniline is treated with sodium nitrite and HCl at 0°C it forms _____
a) Chlorobenzene b) Phenyl hydroxylamine
c) Benzene diazonium chloride d) Phenol

50. Conversion of benzene diazonium chloride to chloro benzene is called
a) Sandmeyer's reaction b) Stephen's reaction
c) Gomberg reaction d) Schotten – Baumann reaction

51. The compound that does not show tautomerism is
a) nitrobenzene b) nitromethane c) nitroethane d) 2-nitropropane

52. Nitro-acinitro tautomerism is exhibited by
a) nitromethane b) nitrobenzene c) chloropicrin d) o-toluidine

53. The reaction between benzene diazonium chloride and benzene in the presence of NaOH is
a) Perkin's reaction b) Gattermann's reaction
c) Sandmeyer reaction **d) Gomberg-Bachmann reaction**

54. Aniline reacts with benzoyl chloride in the presence of sodium hydroxide and gives benzanilide. This reaction is known as
a) Gattermann reaction b) Sandmeyer's reaction

c) Schotten-Baumann reaction d) Gomberg-Bachmann reaction

55. The product obtained when nitrobenzene is treated with Zn / NaOH is

a) aniline b) azoxy benzene c) azo benzene **d) hydrazo benzene**

56. Which one of the following is the most basic ?

a) ammonia b) methylamine **c) dimethylamine** d) aniline

57. Methyl isocyanide on reduction using $LiAlH_4$ is

a) Methyl amine b) Ethyl amine

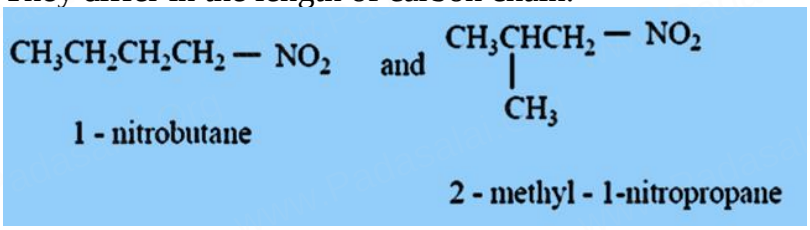
c) Dimethyl amine d) Trimethyl amine

Short answer (BOOK BACK)

1. Write down the possible isomers of the $C_4H_9NO_2$ give their IUPAC names

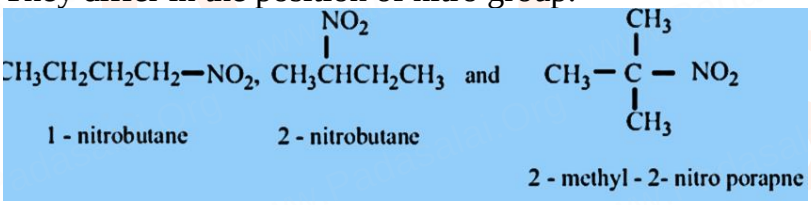
Chain isomerism:

They differ in the length of carbon chain.



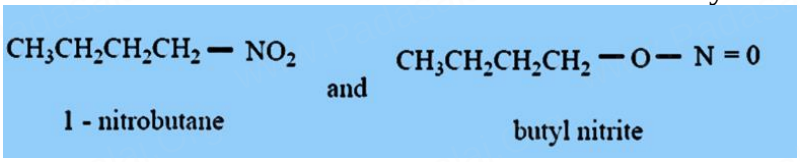
Position isomerism:

They differ in the position of nitro group.



Functional isomerism:

Nitroalkanes exhibit functional isomerism with alkylnitrites



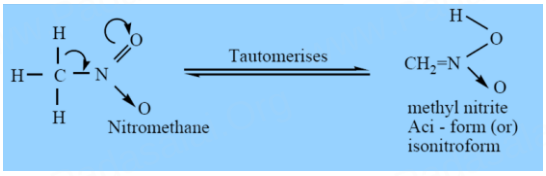
2. There are two isomers with the formula CH_3NO_2 . How will you distinguish between them?

CH_3NO_2 has two isomers

(i) CH_3NO_2 (Nitromethane)

(ii) $CH_2 = NOH$ (Methyl nitrite)

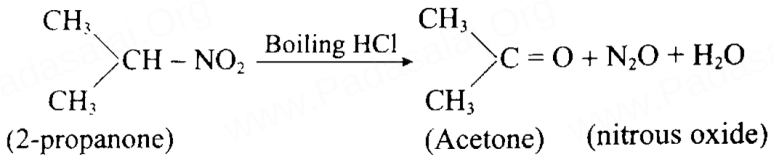
Tautomerism: Primary and secondary nitroalkanes, having α-H , also show an equilibrium mixture of two tautomers namely nitro – and aci – form



Nitro methane (Nitro form)	Methyl nitrite (aci form)
Less acidic	More acidic
Dissolves in NaOH slowly	Dissolves in NaOH instantly
Decolourises $FeCl_3$ solution	With $FeCl_3$ gives reddish brown colour
Electrical conductivity is low	Electrical conductivity is high

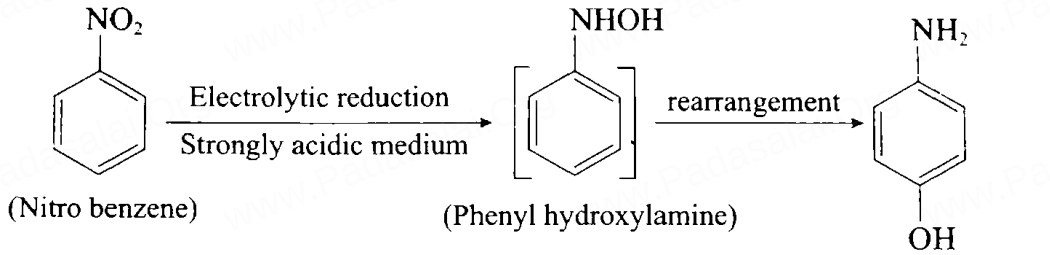
3. What happens when

i. 2 – Nitropropane boiled with HCl



(2-propanone) (Acetone) (nitrous oxide)

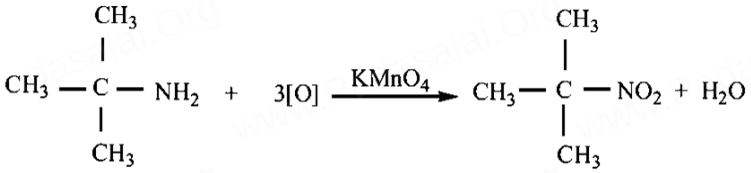
ii. Nitrobenezene electrolytic reduction in strongly acidic medium.



(Nitro benzene) (Phenyl hydroxylamine) (P - amino phenol)

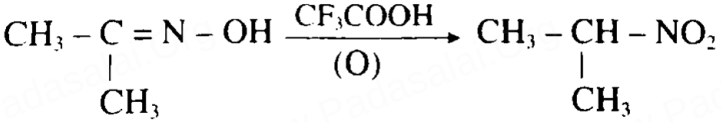
iii. Oxidation of tert – butylamine with $KMnO_4$

tert – butyl amine is oxidised with aqueous $KMnO_4$ to give tert – nitro alkanes



tert-butylamine 2 - methyl - 2 - nitro propane

iv. Oxidation of acetoneoxime with trifluoroperoxy acetic acid.



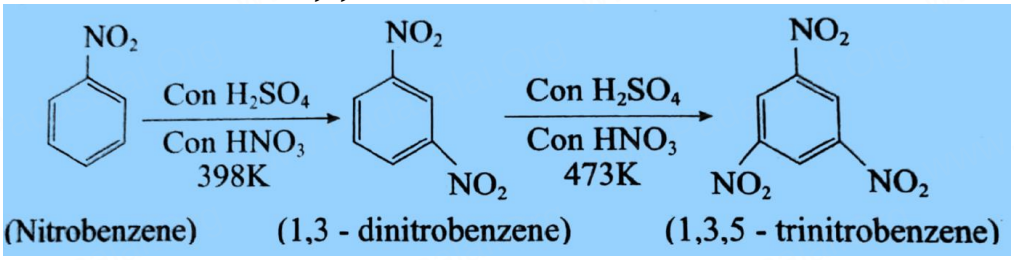
4. How will you convert nitrobenzene into

i. 1,3,5 – trinitrobenzene ii. o and p- nitrophenol iii. m – nitro aniline

iv. azoxybenzene v. hydrozobenzene

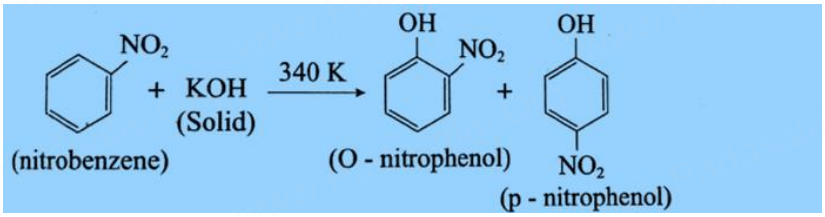
vi. N – phenylhydroxylamine vii. aniline

i. nitrobenzene into 1,3,5 – trinitrobenzene

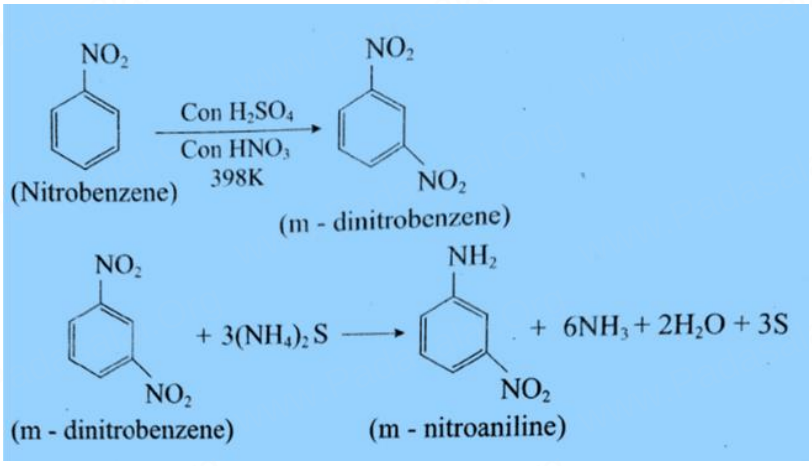


(Nitrobenzene) (1,3 - dinitrobenzene) (1,3,5 - trinitrobenzene)

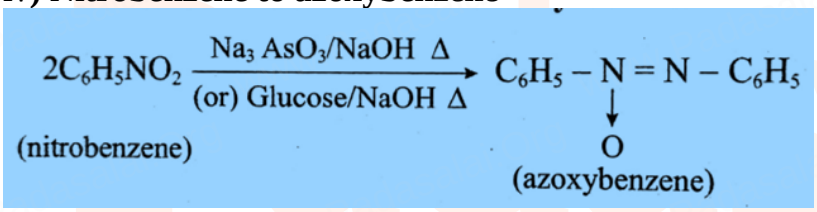
ii.Nitrobenzene to o and p- nitrophenol



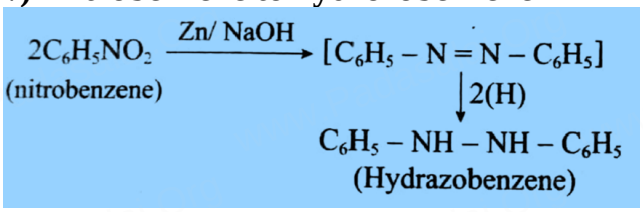
iii. Nitrobenzene to m – nitro aniline



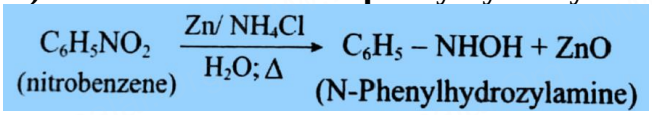
iv) Nitrobenzene to azoxybenzene



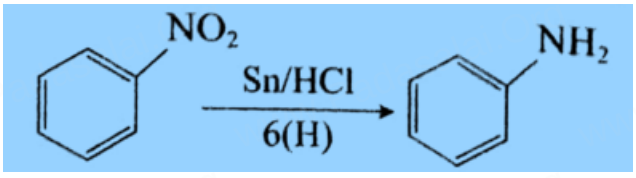
v) Nitrobenzene to hydrozobenzene



vi) Nitro benzene to N – phenylhydroxylamine



vii) Nitro benzene to aniline



5.Identify compounds A , B , C in the following sequence of reactions

i. $C_6H_5NO_2 \xrightarrow{Fe/HCl} A \xrightarrow{HNO_2/273\ K} B \xrightarrow{C_6H_5OH} C$

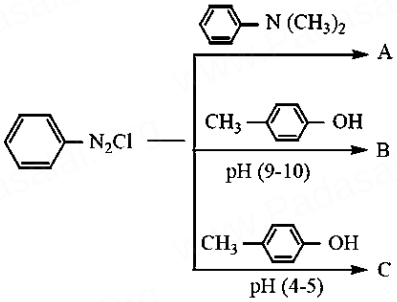
ii. $C_6H_5N_2Cl \xrightarrow{CuCN} A \xrightarrow{H_2O/H^+} B \xrightarrow{NH_3} C$

iii. $CH_3CH_2I \xrightarrow{NaCN} A \xrightarrow{OH^-/Partial\ hydrolysis} B \xrightarrow{NaOH+Br_2} C$

iv. $CH_3NH_2 \xrightarrow{CH_3Br} A \xrightarrow{CH_3COCl} B \xrightarrow{B_2H_6} C$

v. $C_6H_5NH_2 \xrightarrow{(CH_3CO)_2/Pyridine} A \xrightarrow{HNO_3+H_2SO_4/288K} B \xrightarrow{H_2O/H^+} C$

vi.



i. $C_6H_5NO_2 \xrightarrow{Fe/HCl} C_6H_5NH_2 \xrightarrow{HNO_2/273\ K} C_6H_5N_2Cl \xrightarrow{C_6H_5OH}$

Nitrobenzene — Aniline — Benzene diazonium chloride — p-hydroxy azobenzene

ii. $C_6H_5N_2Cl \xrightarrow{CuCN} C_6H_5CN \xrightarrow{H_2O/H^+} C_6H_5COOH \xrightarrow{NH_3} C_6H_5CONH_2$

Cyanobenzene — Benzoic acid — Benzamide

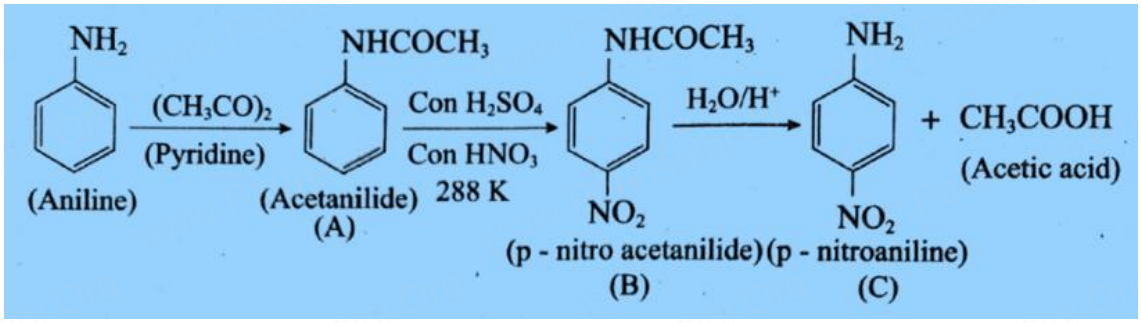
iii. $CH_3CH_2I \xrightarrow{NaCN} CH_3CH_2CN \xrightarrow{OH^-/Partial\ hydrolysis} CH_3CONH_2 \xrightarrow{NaOH+Br_2} CH_3NH_2$

Ethyl iodide — Ethyl cyanide — Acetamide — Methyl amine

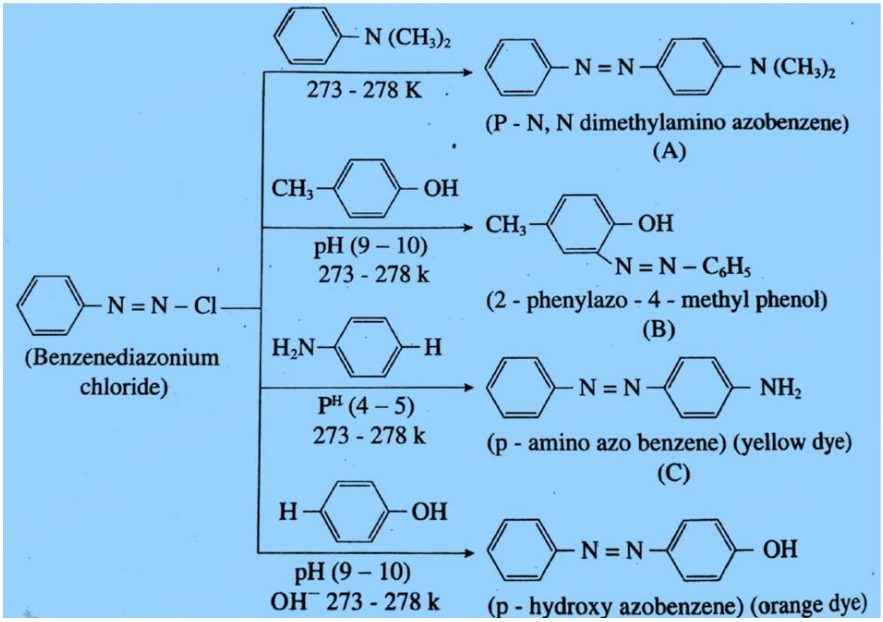
iv. $CH_3NH_2 \xrightarrow{CH_3Br} (CH_3)_2NH \xrightarrow{CH_3COCl} (CH_3)_2NCOCH_3 \xrightarrow{B_2H_6} (CH_3)_2N-CH(OH)-CH_3$

Methyl amine — N, N – dimethyl amine — N, N – dimethyl acetamide — N, N – dimethyl 2 -hydroxy ethan amine

v.



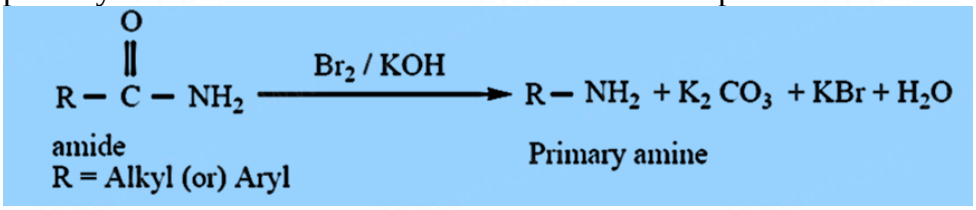
vi.



6. Write short notes on the following
i. Hofmann's bromide reaction
ii. Ammonolysis
iii. Gabriel phthalimide synthesis
iv. Schotten – Baumann reaction
v. Carbylamine reaction
vi. Mustard oil reaction
vii. Coupling reaction
viii. Diazotisation
ix. Gomberg reaction

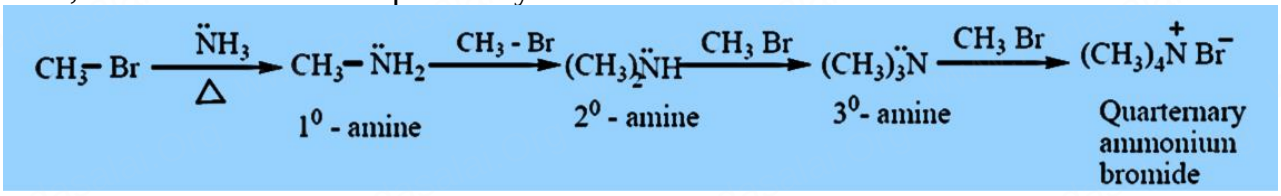
i Hofmann's bromide reaction

When Amides are treated with bromine in the presence of aqueous or ethanolic solution of KOH, primary amines with one carbon atom less than the parent amides are obtained.



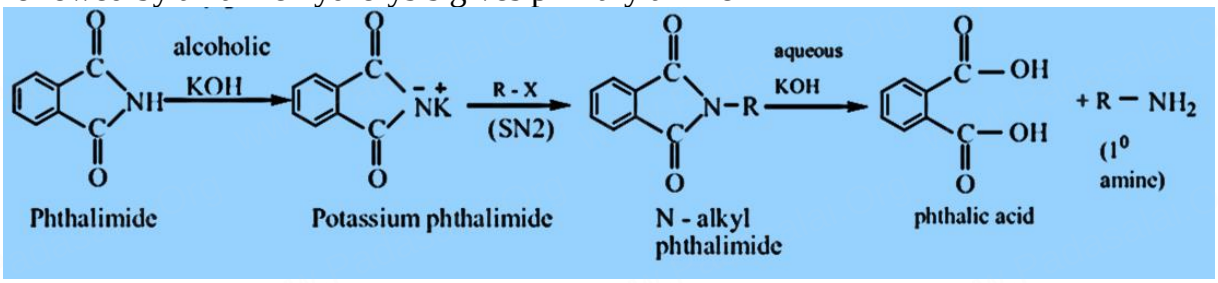
ii. Ammonolysis

When Alkyl halides (or) benzylhalides are heated with alcoholic ammonia in a sealed tube, mixtures of 1^0, 2^0 and 3^0 amines and quaternary ammonium salts are obtained.



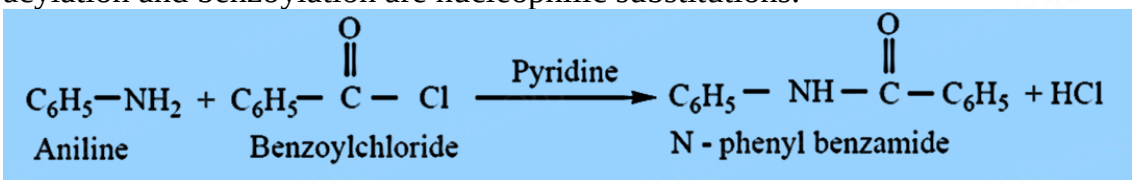
iii. Gabriel phthalimide synthesis

Gabriel synthesis is used for the preparation of Aliphatic primary amines. Phthalimide on treatment with ethanolic KOH forms potassium salt of phthalimide which on heating with alkyl halide followed by alkaline hydrolysis gives primary amine



iv. Schotten – Baumann reaction

Aniline reacts with benzoylchloride in the presence of NaOHto give N – phenyl benzamide The acylation and benzoylation are nucleophilic substitutions.



v.Carbylamine reaction

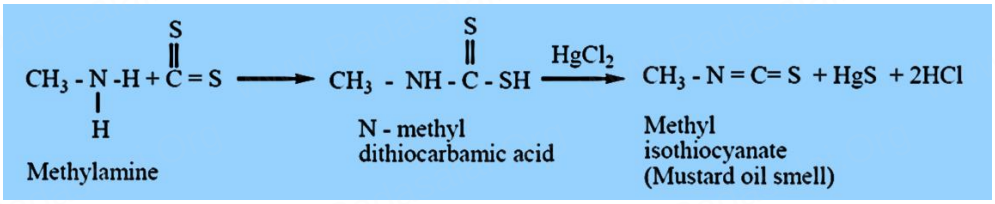
Aliphatic (or) aromatic primary amines react with chloroform and alcoholic KOH to give isocyanides (carbylamines), which has an unpleasant smell.

This test used to identify the primary amines.

$$C_2H_5NH_2 + CHCl_3 + 3KOH \xrightarrow{\text{yields}} C_2H_5NC + 3KCl + 3H_2O$$

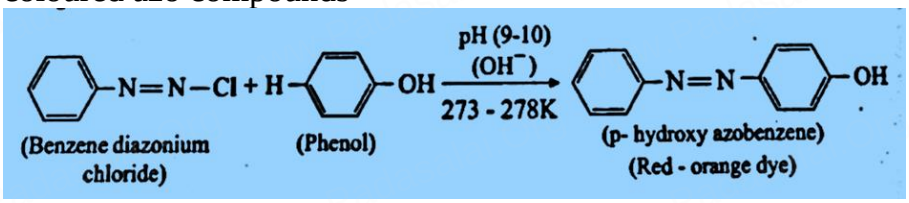
vi. Mustard oil reaction

When primary amines are treated with carbon disulphide (CS_2), N - alkyldithio carbonic acid is formed which on subsequent treatment with $HgCl_2$, give an alkyl isothiocyanate.



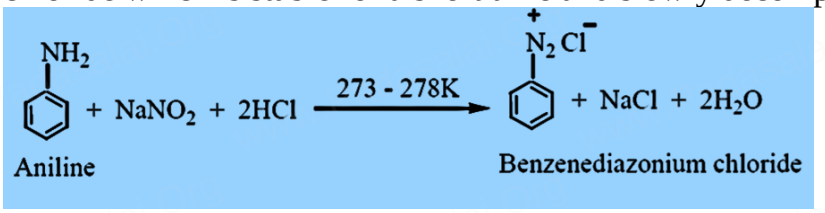
vii.Coupling reaction

Benzene diazonium chloride reacts with electron rich compounds like phenol to form brightly coloured azo compounds



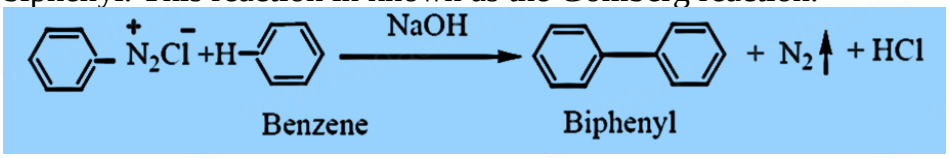
viii. Diazotisation

Aniline reacts with nitrous acid at low temperature (273 – 278 K) to give benzene diazonium chloride which is stable for a short time and slowly decompose seven at low temperatures.



ix. Gomberg reaction

Benzene diazonium chloride reacts with benzene in the presence of sodium hydroxide to give biphenyl. This reaction in known as the Gomberg reaction.



Primary amine	Secondary amine	Tertiary amine
With HNO_2 forms alcohol.	With HNO_2 forms N-nitroso amine	With HNO_2 forms salt.
With $CHCl_3$/KOH forms carbylamines	With $CHCl_3$/KOH no reaction.	With $CHCl_3$/KOH no reaction
With acetyl chloride form N-alkyl acetamide.	With acetyl chloride form N,N-dialkyl acetamide.	With acetyl chloride no reaction
With CS_2 and $HgCl_2$ alkyl isothiocyanate is formed.	With CS_2 and $HgCl_2$ no reaction	With CS_2 and $HgCl_2$ no reaction
With three molar proportion of alkyl halide, Quarternary ammonium salt crystalline compound is formed.	With two molar proportion of alkyl halide Quarternary ammonium salt is formed	With only one molar proportion of alkyl halide , Quarternary ammonium salt

7. How will you distinguish between primary secondary and tertiary alphatic amines.

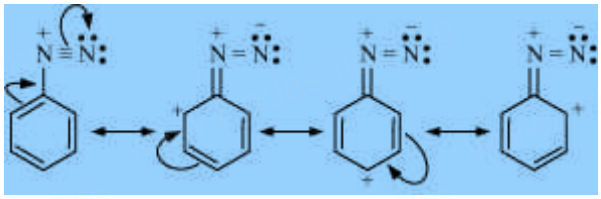
8. Account for the following

i. Aniline does not undergo Friedel – Crafts reaction
ii. Diazonium salts of aromatic amines are more stable than those of aliphatic amines
iii. pKb of aniline is more than that of methylamine
iv. Gabriel phthalimide synthesis is preferred for synthesising primary amines.
v. Ethylamine is soluble in water whereas aniline is not
vi. Amines are more basic than amides
vii. Although amino group is o – and p – directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of m – nitroaniline.

i. Aniline does not undergo Friedel – Crafts reaction

Aniline is basic in nature and it donates its lone pair to the lewis acid $AlCl_3$ to form an adduct which inhibits further the electrophilic substitution reaction.

ii. Diazonium salts of aromatic amines are more stable than those of aliphatic amines



- The diazonium ion undergoes resonance .
- Due to resonance there is dispersal of positive charge on the benzene ring
- The resonance accounts for the stability of the diazonium ion .
- Therefore Diazonium salts of aromatic amines are more stable than those of aliphatic amines

iii. pKb of aniline is more than that of methylamine

- Aniline has higher pK_b than methylamine because methylamine is more acidic than aniline as in methylamine delocalisation of lone pair of electrons belonging to nitrogen occurs
- As a result resonance structures are formed which increase the acidic character of methyl amine as a result it has lesser pK_b value

iv. Gabriel phthalimide synthesis is preferred for synthesising primary amines.

- It results in the formation of primary amine only
- Secondary or tertiary amines are not formed in this synthesis , thus the pure primary amine can be obtained
- Phthalimide is alkylated with alkyl or benzoyl halide and then hydrolysed to get pure primary amine .
- In this method , pthalic acid is produced which can be again converted into phthalimide and used over again and again

v. Ethylamine is soluble in water whereas aniline is not

Aniline does not form H-bond with water due to presence of large Hydrophobic group C_6H_5
Therefore aniline is insoluble in water

vi. Amines are more basic than amides

- The lone pair of electrons on the amine are more available to accept a proton and act as a base.
- This is because in amides, the carbonyl (C=O) group is highly electronegative, so has a greater power to draw electrons towards it, making the lone pair of the amide nitrogen less available to accept a proton.

vii. Although amino group is o – and p – directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of m – nitroaniline.

- The nitration of aniline is acrried out using conc.HNO_3 & H_2SO_4.
- Due to presence of H_2SO_4 ,aniline forms aniline hydrogen sulphate in which the anilinium ion , $C_6H_5NH_3^+$ which is meta directing because the positive charge on the nitrogen attracts electrons from the benzene ring

9. Arrange the following

i. In increasing order of solubility in water, $C_6H_5NH_2$, $(C_2H_5)_2NH$, $C_2H_5NH_2$

ii. In increasing order of basic strength

a) aniline, p- toludine and p – nitroaniline

b) $C_6H_5NH_2$ $C_6H_5NHCH_3$, p-Cl-$C_6H_4NH_2$, $C_2H_5NH_2$

iii. In decreasing order of basic strength in gas phase $C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$ and NH_3

iv. In increasing order of boiling point

C_6H_5OH, $(CH_3)_2NH$, $C_2H_5NH_2$,

v. In decreasing order of the pKb values

$C_2H_5NH_2$, $C_6H_5NHCH_3$, $(C_2H_5)_2NH$ and CH_3NH_2

vi. Increasing order of basic strength

$C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

vii. In decreasing order of basic strength

$CH_3CH_2NH_2$, O_2N–  –NH_2,  –NH_2 , CH_3 - NH_2

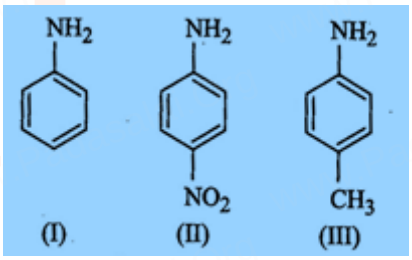
i. In increasing order of solubility in water, $C_6H_5NH_2$, $(C_2H_5)_2NH$, $C_2H_5NH_2$

- The more extensive the H-bonding, the higher is the solubility. $C_2H_5NH_2$ contains two H-atoms whereas $(C_2H_5)_2NH$ contains only one Hatom.
- Further solubility of amine decreases with increase in molecular mass
- $C_6H_5NH_2$ - Highest molecular mass

$C_6H_5NH_2$ < $(C_2H_5)_2NH$ < $C_2H_5NH_2$

ii.

a) **In increasing order of basic strength aniline, p- toludine and p – nitroaniline**



- In the structure (I) – Aniline (II) - p-nitroaniline (III) p – toluidine
- In p – toluidine , the presence of elecytron donating group – CH_3 increases the electron density on the N – atom
- Thus p-toluidine is more basic than aniline
- On the other hand , presence of electron withdrawing – NO_2 group decreases the electron density over the N -atom in p-nitroaniline .
- Thus p – nitroaniline is less basic than aniline

p – nitroaniline < p- toluidine < aniline

b) In increasing order of basic strength $C_6H_5NH_2$ $C_6H_5NHCH_3$, p-Cl-$C_6H_4NH_2$, $C_2H_5NH_2$

- $C_6H_5NHCH_3$ is more basic than $C_6H_5NH_2$ due to the presence of electron-donating $-CH_3$ group in $C_6H_5NHCH_3$. Again, in $C_6H_5NHCH_3$ $-C_6H_5$ group is directly attached to the N-atom.
- Thus, in $C_6H_5NHCH_3$, the $-R$ effect of $-C_6H_5$ group decreases the electron density over the N-atom.
- Chlorine atom has both -I effect and + R effect since -I effect out weights the +R effect , therefore p – chloroanilline is weak base than aniline
- Alkyl groups are electron – donating group . As a result the electron density on the nitrogen atom increases in the ethylamine and thus they can donate lone pair of electrons easily .So it is more basic than aromatic amine

p-Cl-$C_6H_4NH_2$ < $C_6H_5NH_2$ < $C_6H_5NHCH_3$ < $C_2H_5NH_2$

iii)In decreasing order of basic strength in gas phase $C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$ and NH_3

- NH_3 In gas phase there is no hydrogen bonding , therefore stabalisation due to hydrogen bonding is not there. Therfore the only effect to determine the strength is the inductive effect.
- The +I effect increases with increase in the alkyl group.
- Therefore the basic strength will be the highest in $(C_2H_5)_3N$ and least in NH_3.

$(C_2H_5)_3N$ > $(C_2H_5)_2NH$ > $C_2H_5NH_2$ > NH_3

iv)In increasing order of boiling point C_6H_5OH, $(CH_3)_2NH$, $C_2H_5NH_2$,

- Boiling points of compounds depend on the extent of H-bonding present in that compound.
- The more extensive the H-bonding in the compound, the higher is the boiling point.
- $(CH_3)_2NH$ contains only one H−atom whereas $C_2H_5NH_2$ contains two H-atoms.
- Then, $C_2H_5NH_2$ undergoes more extensive H-bonding than $(CH_3)_2NH$.
- Hence, the boiling point of $C_2H_5NH_2$ is higher than that of $(CH_3)_2NH$.
- Further, O is more electronegative than N. Thus, C_6H_5OH forms stronger H−bonds than $C_2H_5NH_2$.
- As a result, the boiling point of C_6H_5OH is higher than that of $C_2H_5NH_2$and $(CH_3)_2NH$.

$(CH_3)_2NH$ < $C_2H_5NH_2$ < C_6H_5OH

v)In decreasing order of the pKb values$C_2H_5NH_2$, $C_6H_5NHCH_3$, $(C_2H_5)_2NH$ and CH_3NH_2

- In $C_2H_5NH_2$, only one -C_2H_5 group is present while in $(C_2H_5)_2NH$, two -C_2H_5 groups are present.
- Thus, the +I effect is more in $(C_2H_5)_2NH$ than in $C_2H_5NH_2$.
- Therefore, the electron density over the N-atom is more in $(C_2H_5)_2NH$ than in $C_2H_5NH_2$.
- Hence, $(C_2H_5)_2NH$ is more basic than $C_2H_5NH_2$.
- Also, both $C_6H_5NHCH_3$ and $C_6H_5NH_2$ are less basic than $(C_2H_5)_2NH$ and $C_2H_5NH_2$ due to the delocalization of the lone pair in the former two.
- Further, among C_6H_5NHCH and $C_6H_5NH_2$, the former will be more basic due to the +I effect of -CH_3 group.

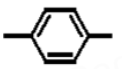
$(C_2H_5)_2NH$ > $C_2H_5NH_2$ > CH_3NH_2 > $C_6H_5NHCH_3$

vi)Increasing order of basic strength $C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

- $C_6H_5N(CH_3)_2$ is more basic than $C_6H_5NH_2$ due to the presence of the +I effect of two -CH_3 groups in $C_6H_5N(CH_3)_2$. Further, CH_3NH_2 contains one -CH_3 group while $(C_2H_5)_2NH$ contains two -C_2H_5 groups.
- Thus,$(C_2H_5)_2NH$ is more basic than CH_3NH_2 .
- Now, $C_6H_5N(CH_3)_2$ is less basic than CH_3NH_2 because of the-R effect of -C_6H_5 group.

$C_6H_5NH_2$ < $C_6H_5N(CH_3)_2$ < CH_3NH_2 < $(C_2H_5)_2NH$

vii In decreasing order of basic strength

$CH_3CH_2NH_2$, O_2N–  –NH_2,  –NH_2 , CH_3 - NH_2

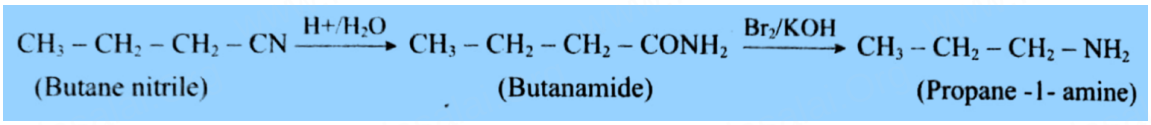
- Aliphatic amines are more basic than aromatic amines.
- $CH_3CH_2NH_2$ and CH_3NH_2 are more basic .
- Nitro group has a powerful electron withdrawing group and have both -R effect as well as -I effect .

- As a result all the nitro anilines are weaker bases than aniline .

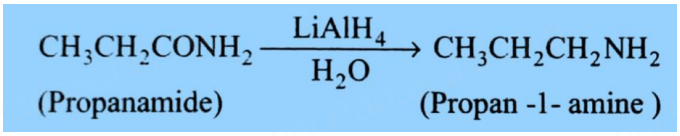
Ethylamine > Methyl amine > Aniline > p-nitro aniline

10. How will you prepare propan – 1- amine from i) butane nitrile ii) propanamide iii) 1- nitropropane

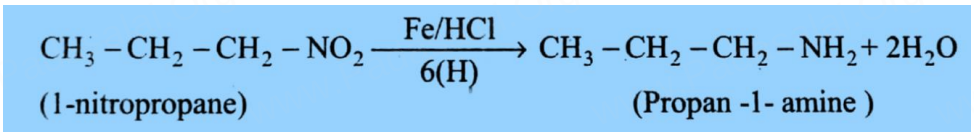
i)propan – 1- amine from butane nitrile



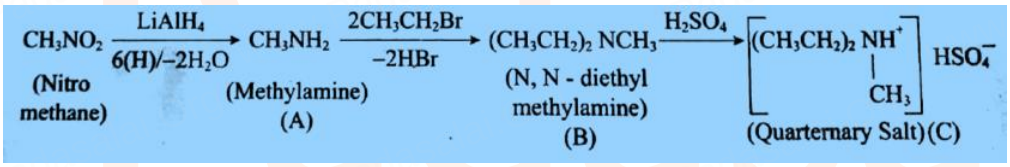
ii) propan – 1- amine from)propanamide 1- nitropropane



iii) propan – 1- amine from 1- nitropropane

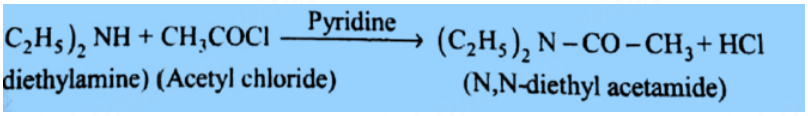


11. CH_3NO_2 $\xrightarrow{LIAlH_4}$ **A** $\xrightarrow{2CH_3CH_2Br}$ **B** $\xrightarrow{H_2SO_4}$ **C**

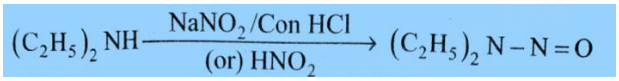


12. How will you convert diethylamine into i) N, N – diethylacetamide ii) N – nitrosodiethylamine

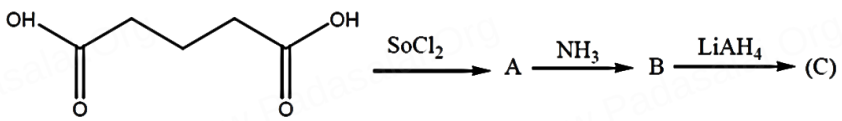
i) Diethylamine into N, N – diethylacetamide

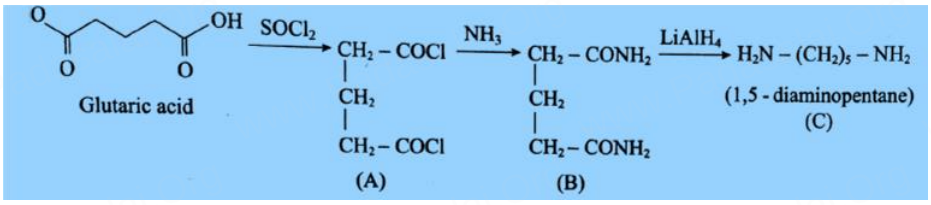


ii) Diethylamine into N – nitrosodiethylamine



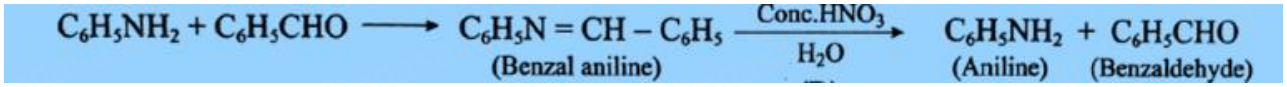
13.Identify A , B , C





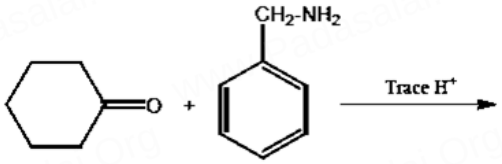
14. Identify A,B,C and

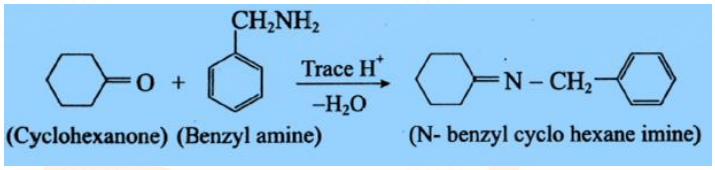
Aniline + benzaldehyde → $A \xrightarrow{ConHNO_3} B + C$



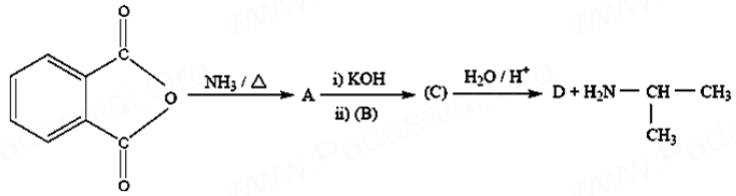
(A) (B) (C)

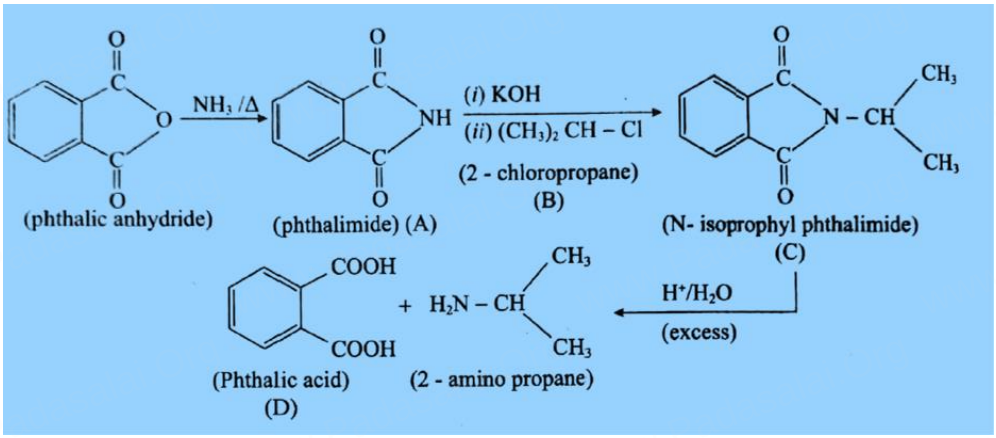
15. Complete the following reaction



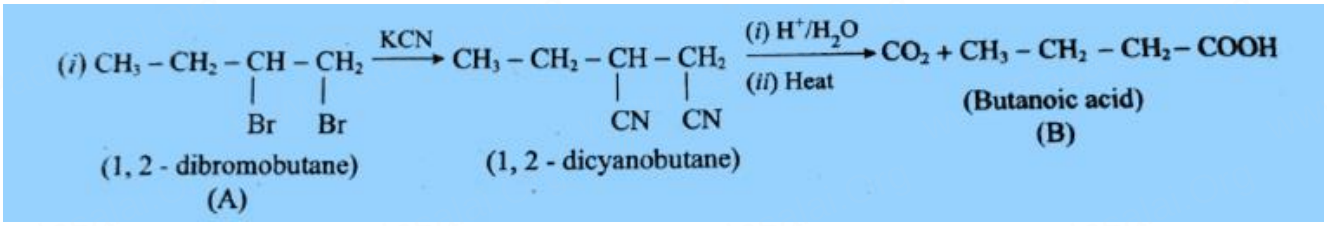


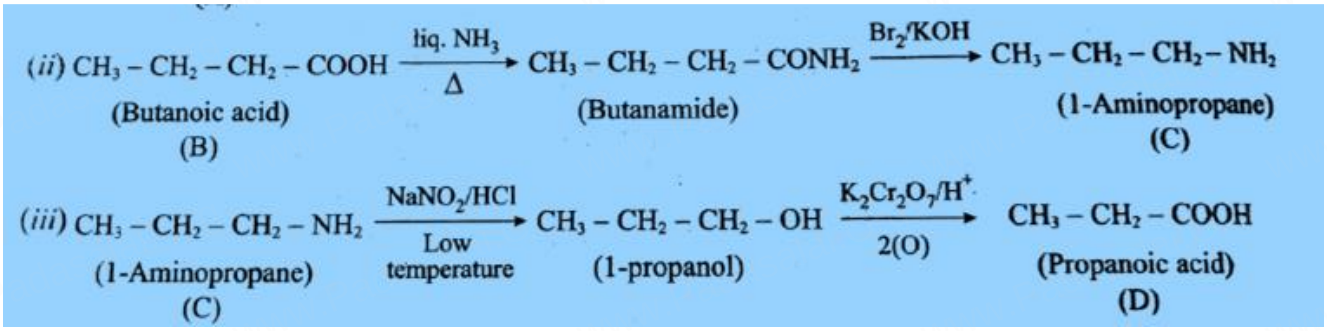
16. Predict A,B,C and D for the following reaction





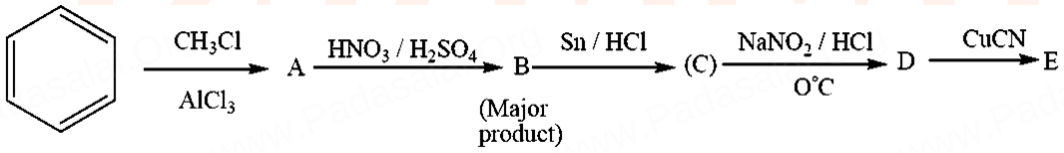
17. A dibromo derivative (A) on treatment with KCN followed by acid hydrolysis and heating gives a monobasic acid (B) along with liberation of CO_2 . (B) on heating with liquid ammonia followed by treating with Br_2 /KOH gives (c) which on treating with $NaNO_2$ and HCl at low temperature followed by oxidation gives a monobasic acid (D) having molecular mass 74. Identify A to D.

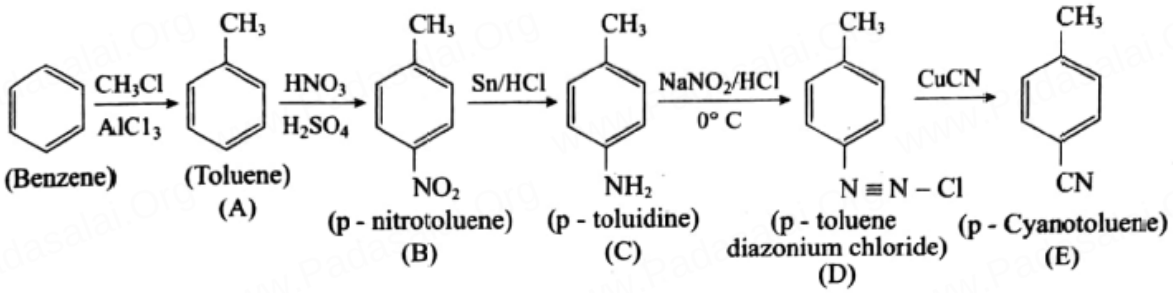




Compound	Name
A	1 , 2 – dibromobutane
B	Butanoic acid
C	1-Aminopropane
D	Propionic acid

18. Identify A to E in the following frequency of reactions





Compound	Name
A	Toluene
B	p-nitrotoluene
C	p-toluidine
D	p-toluene diazonium chloride
E	p-Cyanotoulene

Evaluate yourself

Write all possible isomers for the following compounds.i) C_2H_5 -NO_2 ii) C_3H_7 -NO_2

i) possible isomers of C_2H_5 -NO_2

(a) $CH_3 - CH_2 - NO_2$ - Nitroethane

(b) $CH_3 - CH_2 - O - N = O$ - Ethyl nitrite

(c) $CH_3 - CH = N - O - H$ - Aci - form (ethyl nitrite)

O

(d) $H_2N - CH_2 - COOH$ - Glycine (amino acid)

(e) H_3C, $C = N$, OH, OH - Acetohydroxamic acid

(f) $H_3C - O - C - NH_2$ - Methyl carbamate

O

ii) possible isomers of C_3H_7 -NO_2

(a) $CH_3 - CH_2 - CH_2 - NO_2$ - 1 - Nitropropane

(b) $CH_3 - CH_2 - CH_2 - O - N = O$ - propane - 1 - nitrite

(c) $CH_3 - CH_2 - CH = N - O - H$ - Aci form (propan - 1 - nitrite)

O

(d) $CH_3 - CH(NO_2) - CH_3$ - 2 - nitro propane

(e) $CH_3 - C(=N-O-H) - CH_3$ - propan - 2 - nitrite (Aci - form)

O

(f) $H_2N - CH_2 - CH_2 - COOH$ - Alanine

2. Find out the product of the following reactions.

i) $CH_3CH(Cl)COOH \xrightarrow[ii)\ H_2O/\Delta]{i)\ NaNO_2} ?[X]$ ii) $CH_3CH_2\text{-}Br + NaNO_2 \xrightarrow{\text{alcohol }/\Delta} [Y]$

(i) $CH_3 - CH(Cl) - COOH + NaNO_2 \xrightarrow{H_2O/\Delta} CH_3 - CH_2 - NO_2 + NaCl + CO_2$

(α - Chloropropionic acid) (Nitro ethane) (X)

(ii) $CH_3 - CH_2 - Br + NaNO_2 \xrightarrow{\text{alcohol}/\Delta} CH_3 - CH_2 - NO_2 + NaBr$

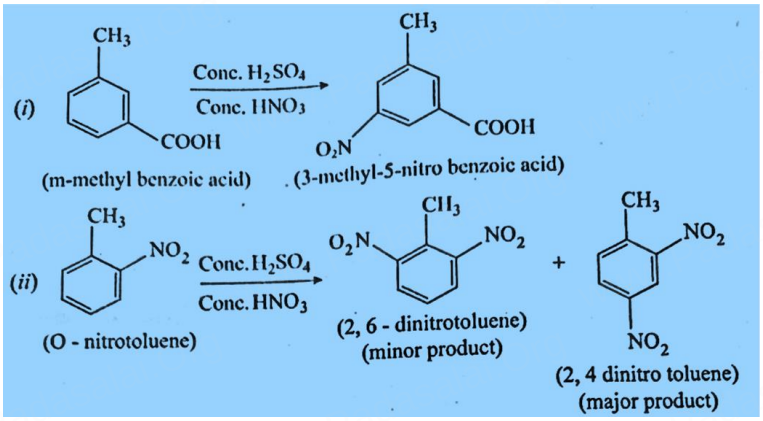
(Ethyl bromide) (Nitro ethane) (Y)

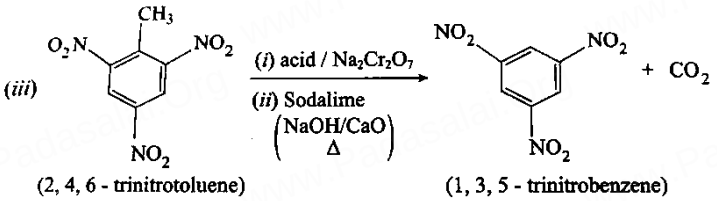
3. Predict the major product that would be obtained on nitration of the following compounds

i) CH_3, COOH — $\xrightarrow{Con\ H_2SO_4 + Con.HNO_3}$?

ii) CH_3, NO_2 — $\xrightarrow{Con\ H_2SO_4 + Con.HNO_3}$

iii) CH_3, O_2N, NO_2, NO_2 — $\xrightarrow[ii)\ Sodalime]{i)\ acid\ Na_2Cr_2O_7}$?





4. Draw the structure of the following compounds

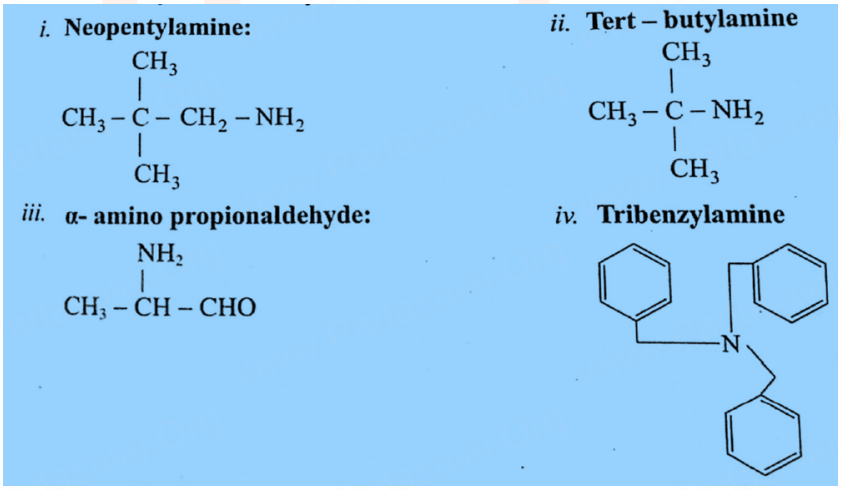
i. Neopentylamine

ii. Tert – butylamine

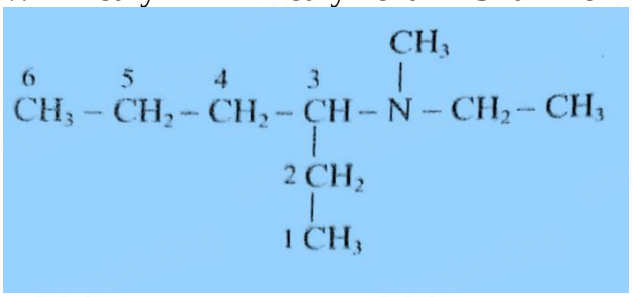
iii. α- amino propionaldehyde

iv. Tribenzylamine

v. N – ethyl – N – methylhexan – 3- amine

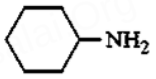
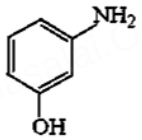
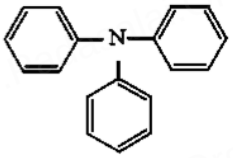


v. N – ethyl – N – methylhexan – 3- amine



5) Give the correct IUPAC names for the following amines

i) $CH_3 - CH_2 - CH_2 - \underset{\displaystyle NH_2}{\underset{|}{CH}} - CH_3$ ii) $CH_3 - CH_2 - \underset{\displaystyle NH\,CH_3}{\underset{|}{CH}} - CH_3$

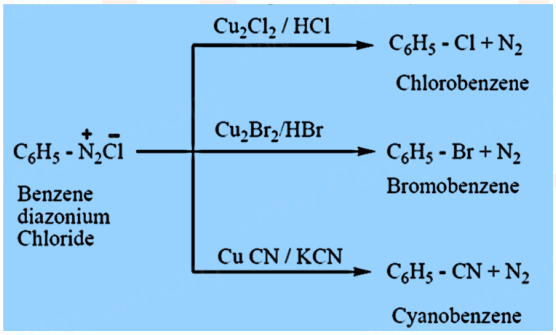
iii)  iv)  v) 

i)Pentan-2-amine
ii)N-methyl -butane -2-amine
iii)Cyclohexylamine
iv)3-amino phenol
v)N.N.N-triphenylamine

Naming reaction

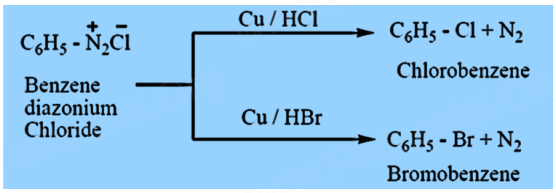
1. Sandmeyer reaction

- On mixing freshly prepared solution of benzene diazonium chloride with cuprous halides(chlorides and bromides), aryl halides are obtained. This reaction is called Sandmeyer reaction.
- When diazonium salts are treated with cuprous cyanide, cyanobenzene is obtained



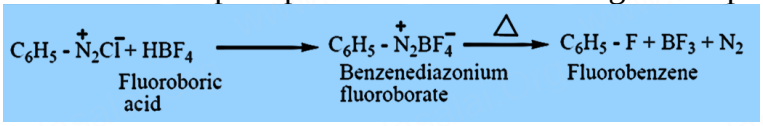
2. Gattermann reaction

Conversion of benzene diazonium chloride into chloro / bromo arenes can also be effected using hydrochloric / hydrobromic acid and copper powder.
This reaction is called Gattermann reaction.



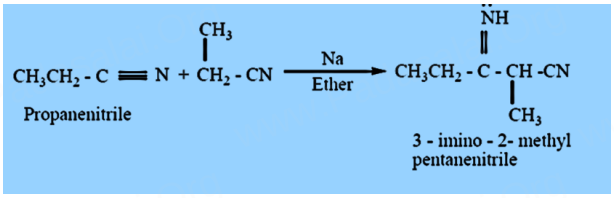
3. Baltz – schiemann reaction

When benzene diazonium chloride is treated with fluoroboric acid, benezene diazonium tetra fluoroborate is precipitated which on heating decomposes to give fluorobenzene.



4. Thrope nitrile condensation

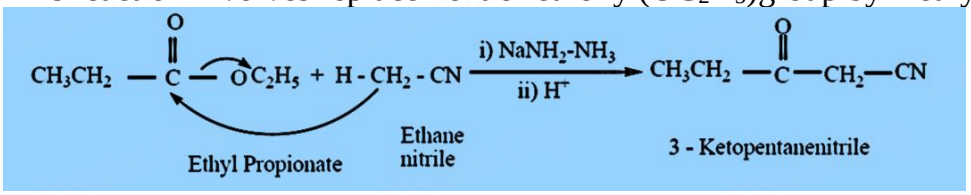
Self condensation of two molecules of alkyl nitrile (containing a–H atom) in the presence of sodium to form iminonitrile.



5. Levine and hauser" acetylation OR cyanomethylation reaction.

The nitriles containing α- hydrogen also undergo condensation with esters in the presence of sodamide in ether to form ketonitriles

This reaction involves replacement of ethoxy (OC_2H_5)group by methylnitrile (- CH_2CN) group



Short answers

1. Why nitrobenzene cannot be prepared by reaction of alkyl halide with potassium nitrite ?

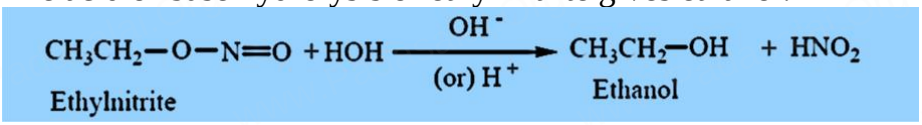
This method is not suitable for preparing nitrobenzene because the bromine directly attached to the benzene ring cannot be cleaved easily.

2.How will you prepare ethanol from ethylnitrite

$$CH_3CH_2 - O - N = O \xrightarrow{Sn/HCl} CH_3CH_2OH + NH_3 + H_2O$$

Ethylnitrite on reduction with Sn / HCl gives ethanol

The acid or base hydrolysis of ethyl nitrite gives ethanol.



3.How will you prepare chloropicrin?

$$CH_3NO_2 + 3Cl_2 \xrightarrow{NaOH} CCl_3NO_2 + 3HCl$$

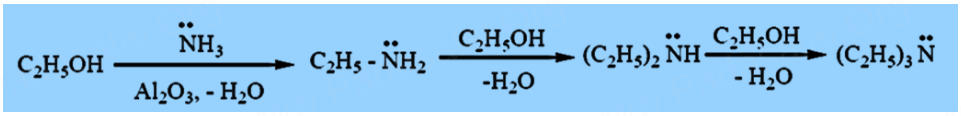
Primary and secondary nitroalkanes on treatement with Cl_2 or Br_2 in the presence of NaOH give halonitroalkanes.

4.Why aniline cannot be prepared by Gabriel Pthalimide synthesis

Aniline cannot be prepared by this method because the arylhalides do not undergo nucleophilic substitution with the anion formed by phthalimide

5. What is Sabatier – Mailhe method ?

When vapour of an alcohol and ammonia are passed over alumina, W_2O_5 (or) silica at 400^0C, all types of amines are formed.

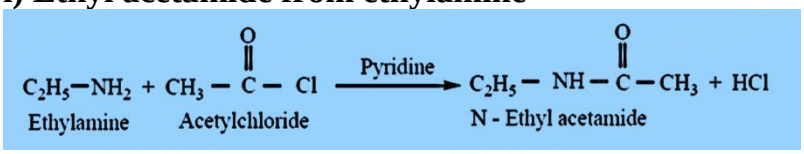


6. Why Amines have lower boiling point than alcohols?

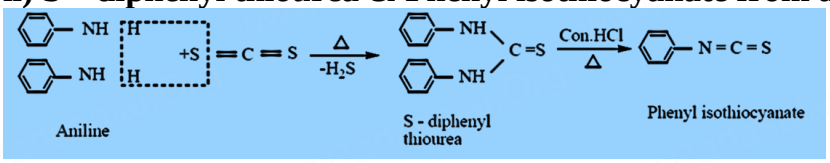
Amines have lower boiling point than alcohols because nitrogen has lower electronegative value than oxygen and hence the N-Hbond is less polar than -OH bond.

7.How will you prepare

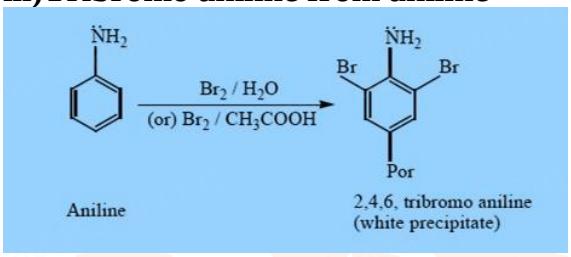
i) Ethyl acetamide from ethylamine



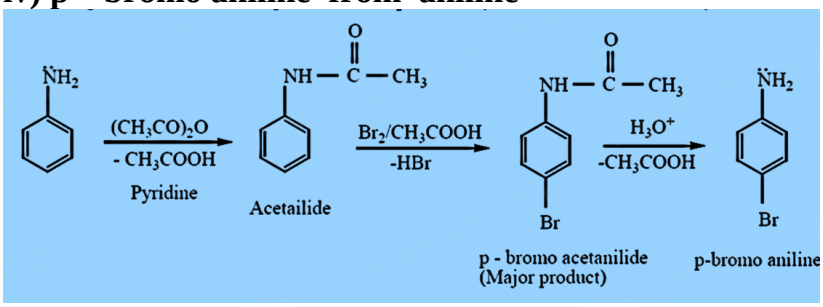
ii) S – diphenyl thiourea & Phenyl isothiocyanate from anilne



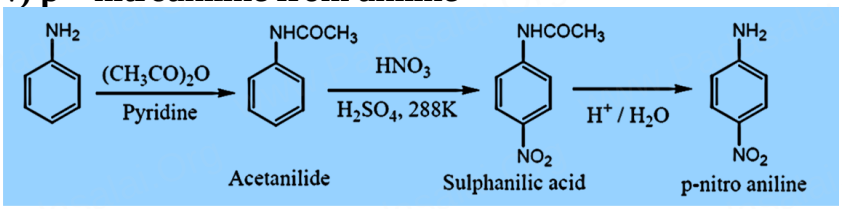
iii)Tribromo aniline from aniline



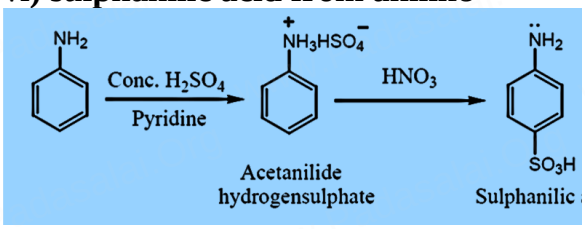
iv) p – bromo aniline from aniline



v) p – nitroaniline from aniline

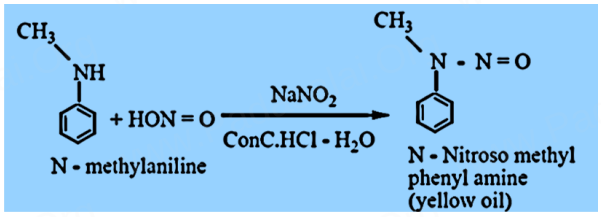


vi) sulphanilic acid from aniline



8.What is Libermann's nitroso test,

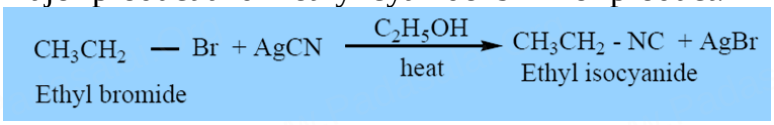
Alkyl and aryl secondary amines react with nitrous acid to give N – nitroso amine as yellow oily liquid which is insoluble in water.



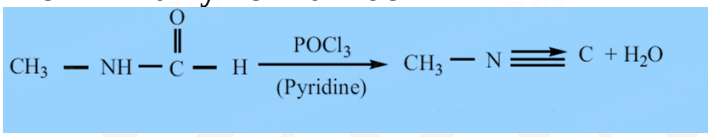
9.How will you prepare methyl isocyanide ?

From ethyl bromide

Ethyl bromide on heating with ehanolic solution of AgCN give methyl isocyanide as major product and methyl cyanide is minor product.

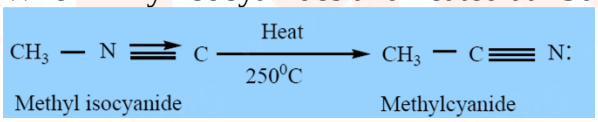


From N – alkyl formamide



10.How does methylisocyanide can be converted to methylcyanide

When Alkyl isocyanides and heated at 250^0C, they change into the more stable, isomeric cyanides

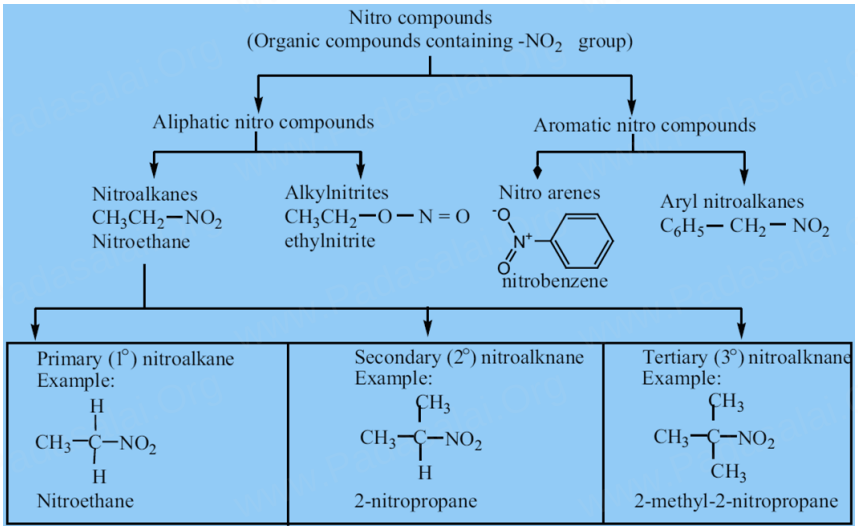


11. Why cannot aromatic primary amines be prepared by Gabriel phthalimide synthesis?

- The success of Gabriel phthalimide reaction depends upon the nucleophilic attack by the phthalimide anion on the organic halogen compound.
- Since aryl halides do not undergo nucleophilic substitution reactions easily, therefore, arylamines, i.e. aromatic, primary amines cannot be prepared by Gabriel phthalimide reaction.

Long answers

1.Write down the classification of Nitro compounds



2.How will you prepare nitroalkane from i) alkyl halides ii) Vapour phase nitration of alkanes: (Industrial method) iii)a- halocarboxylic acid

(i) From alkyl halide

Alkyl bromides (or) iodides on heating with ethanolic solution of potassium nitrite gives nitroethane.

$$\underset{\text{Ethyl bromide}}{CH_3CH_2\text{-}Br} + KNO_2 \xrightarrow[SN^2]{\text{ethanol}/\Delta} \underset{\text{Nitroethane}}{CH_3CH_2\text{-}NO_2} + KBr$$

(ii) Vapour phase nitration of alkanes

Gaseous mixture of methane and nitric acid passed through a red hot metal tube to give nitromethane.

$$\underset{\text{Methane}}{CH_{4(g)}} + HNO_{3\,(g)} \xrightarrow[\text{Red hot Si tube}]{675\ K} \underset{\text{nitro methane}}{CH_3\text{-}NO_2} + H_2O$$

Except methane, other alkanes (upto n – hexane) give a mixture of nitroalkanes due to C-C cleavage. The individual nitro alkanes can be separated by fractional distillation.

$$\underset{\text{Ethane}}{CH_3\text{-}CH_3} + HNO_3 \xrightarrow{675\ K} \underset{\text{Nitroethane(73\%)}}{CH_3CH_2\text{-}NO_2} + \underset{\text{Nitromethane (27\%)}}{CH_3NO_2}$$

From a- halocarboxylic acid

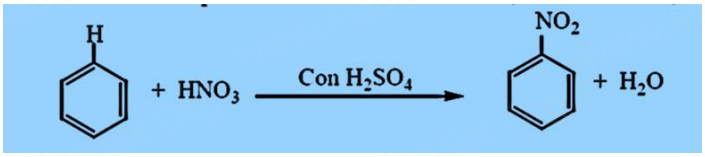
α-choloroacetic acid when boiled with aqueous solution of sodium nitrite gives nitromethane.

$$\underset{\alpha\text{ - chloro acetic acid}}{Cl\text{-}CH_2\text{-}COOH} + NaNO_2 \xrightarrow[SN^2]{H_2O/\text{Heat}} \underset{\text{Nitromethane}}{CH_3\text{-}NO_2} + CO_2 + NaCl$$

3.How will you Prepare Nitroarenes

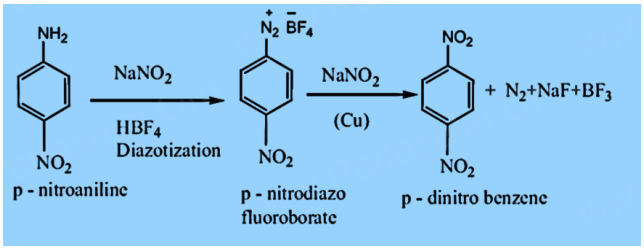
By Direct nitration

When benzene is heated at 330K with a nitrating mixture (Con.HNO_3 + Con.H_2SO_4) ,electrophilic substitution takes place to form nitro benzene. (Oil of mirbane)

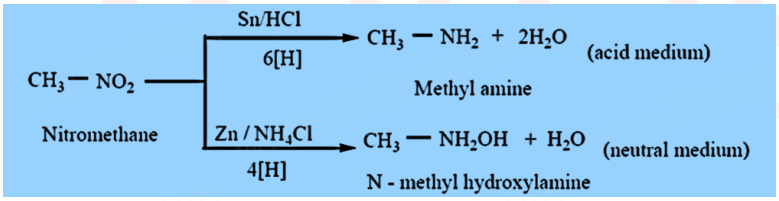


Indirect method

Nitration of nitro benzene gives m-dinitrobenzene. The following method is adopted for the preparation of p-dinitrobenzene.

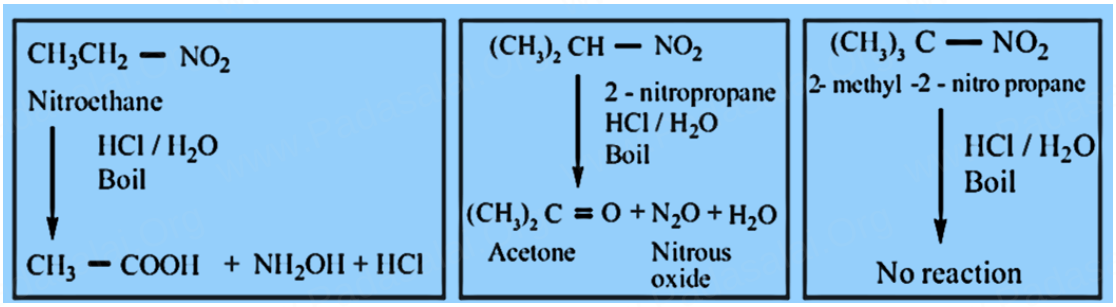


4.How will you prepare methyl amine and N – methyl hydroxylamine amine from nitromethane

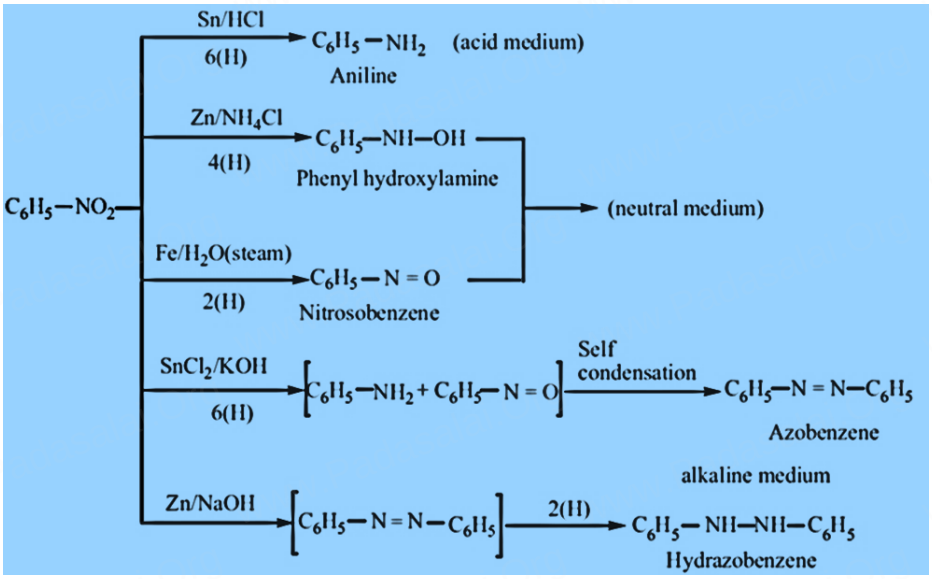


5. Write about Hydrolysis of nitroalkanes

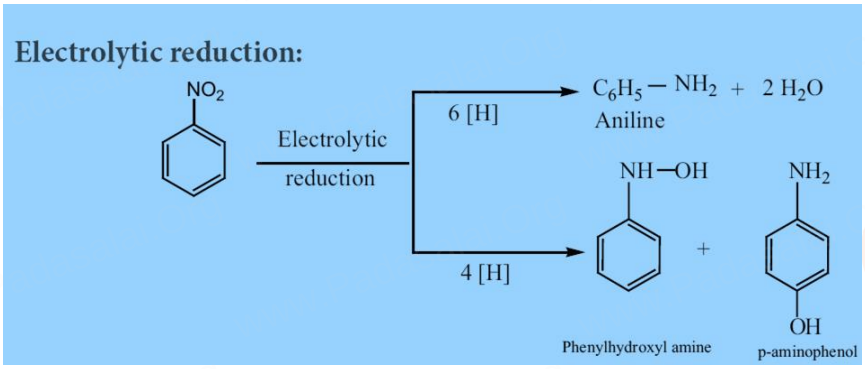
- Hydrolysis can be effected using conc. HCl or conc. H_2SO_4 .
- Primary nitroalkanes on hydrolysis gives carboxylic acid
- Secondary nitroalkanes give ketones.
- Tertiary nitroalkanes have no reaction.



6.Explain about reduction of nitrobenzene in different medium



Electrolytic reduction



Reduction of catalytic and metal hydrides

Nitrobenzene reduction with Ni (or) Pt, (or) $LiAlH_4$ to give aniline

$$C_6H_5 - NO_2 + 6[H] \xrightarrow[(or)\ LiAlH_4]{Ni\ (or)\ Pt\ /\ H_2} C_6H_5 - NH_2 + 2H_2O$$

6.How will you convert benzene diazonium chloride to

i)Benzene

$$C_6H_5 - N_2Cl + CH_3CH_2OH \xrightarrow{yields} C_6H_6 + N_2 + CH_3CHO + HCl$$

ii) iodobenzene

$$C_6H_5N_2Cl + KI \longrightarrow C_6H_5I + N_2 + KCl$$

iii) Phenol

$$C_6H_5N_2Cl + H_2O \xrightarrow{\Delta/283K} C_6H_5OH + N_2 + HCl$$

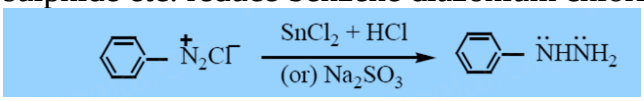
iv) Benzoic acid

When diazonium fluoroborate is heated with acetic acid, benzoic acid is obtained. This reaction is used to convert the of aliphatic carboxylic acid into aromatic carboxylic acid.

$$C_6H_5N_2Cl + HBF_4 \rightarrow C_6H_5N_2BF_4 \xrightarrow{CH_3COOH} C_6H_5COOH + BF_3 + CH_3F$$

v)phenyl hydrazine

Certain reducing agents like $SnCl_2$ / HCl ; Zn dust / CH_3COOH, sodium hydrosulphide, sodium sulphide etc. reduce benzene diazonium chloride to phenyl hydrazine.



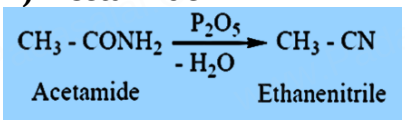
7.How will you prepare propanenitrile from

i)Methyl bromide

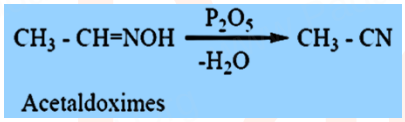
When alkyl halides are treated in the solution NaCN (or) KCN , alkyl cyanides are obtained.

$$CH_3Br + KCN \longrightarrow CH_3CN + KBr$$

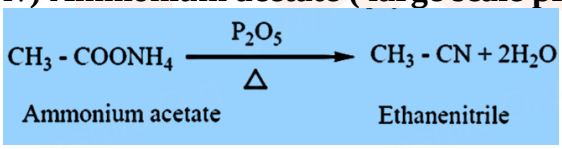
ii) Acetamide



iii) From acetaldoximes



iv) Ammonium acetate (large scale preparation of alkyl nitrile)



v) Grignard reagent

$$CH_3MgBr + Cl - CN \longrightarrow CH_3CN + Mg(Br)Cl$$

8.Uses of organic nitrogen compounds

Nitroalkanes

1. Nitromethane is used as a fuel for cars
2. Chloropicrin (CCl_3NO_2) is used as an insecticide
3. Nitroethane is used as a fuel additive and precursor to explosive and they are good solvents for polymers, cellulose ester, synthetic rubber and dyes etc.,
4. 4% solution of ethylnitrite in alcohol is known as sweet spirit of nitre and in used as diuretic.

Nitrobenzene

• Nitrobenzene is used to produce lubricating oils in motors and machinery.
• It is used in the manufacture of dyes, drugs, pesticides, synthelic rubber, aniline and explosives like TNT, TNB.

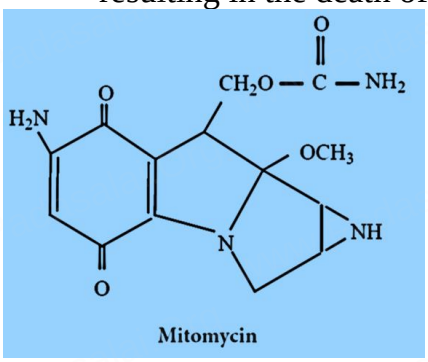
Cyanides and isocyanides

Alkyl cyanides are important intermediates in the organic synthesis of larger number of compounds like acids, amides, esters, amines etc.

• Nitriles are used in textile industry in the manufacture of nitrile rubber and also as asolvent particularly in perfume industry.

9. What is Mitomycin C ? Write down its structure and explain its uses

- Mitomycin C used to treat stomach and colon cancer, contains an aziridine ring.
- The aziridine functional group participates in the drug's degradation by DNA,
- resulting in the death of cancerous cells.



Mitomycin

10. Give one chemical test to distinguish between the following pairs of compounds:

(i) Methylamine and dimethylamine
(ii) Secondary and tertiary amines
(iii) Ethylamine and aniline
(iv) Aniline and benzylamine
(v) Aniline and N-Methylaniline.

(i) Methylamine and dimethylamine can be distinguished by carbylamine test.
Methylamine will undergoes carbylamines test since it is primary amine , whereas dimethylamine does not undergo carbylamines since it is secondary amine

(ii) Secondary and tertiary amine can be distinguished by Liebermann's nitroamine test. Secondary amines gives Liebermann nitroamine test while tertiary amines do not.

(iii)Ethylamine and aniline can be distinguished by azo test .
Aniline will undergo azo reaction to form p-hydroxy azo benzene , whereas ethylamine will not .

(iv) Aniline and benzylamine can be distinguished by nitrous acid test

(v)Aniline and N-methylaniline can be distinguished by carbylamines test
Aniline will undergoes carbylamines test since it is primary amine , whereas N-methylaniline does not undergo carbylamines since it is secondary amine

11. Give plausible explanation for each of the following:

(i) Why are amines less acidic than alcohols of comparable molecular masses?
(ii) Why do primary amines have higher boiling point than tertiary amines?
(iii)Why are aliphatic amines stronger bases than aromatic amines?

i)

- Loss of proton from an amine gives an amide ion while loss of a proton from alcohol give an alkoxide ion.
- Since O is more electronegative than N, so it will attract positive species more strongly in comparison to N. Thus, RO is more stable than RNH^-. Thus, alcohols are more acidic than amines. Conversely, amines are less acidic than alcohols.

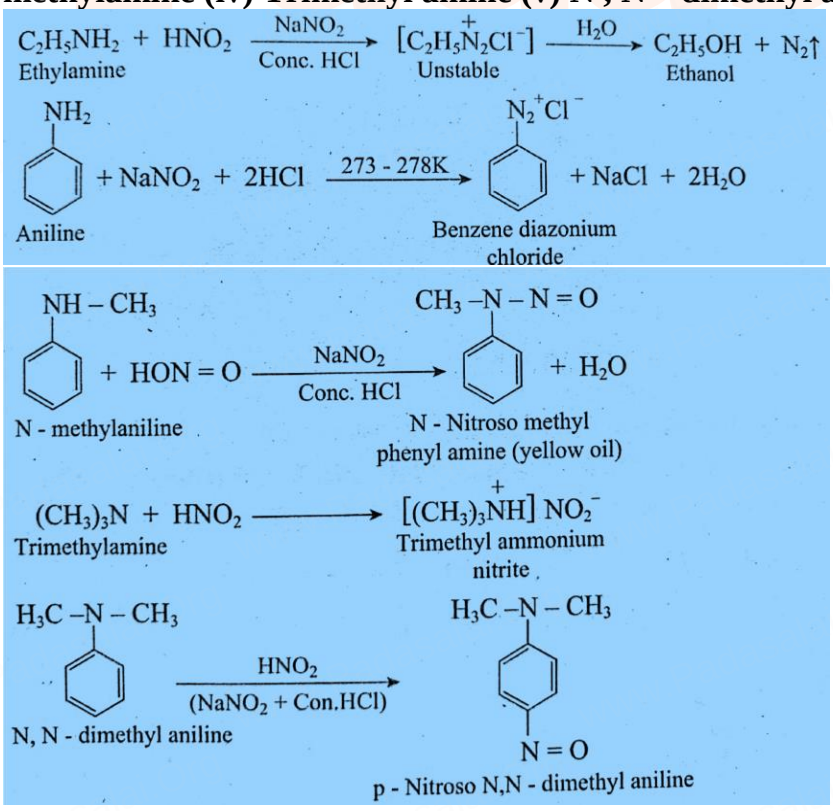
(ii)

- Due to the presence of two H-atoms on N-atom of primary amines, they undergo extensive intermolecular H-bonding while tertiary amines due to the absence of H-atom on the N-atom do not undergo H-bonding.
- As a result, primary amines have higher boiling points than tertiary amines of comparable molecular mass.

(iii)

- Aromatic amines are far less basic than ammonia and aliphatic amines because of following reasons:
- Due to resonance in aniline and other aromatic amines, the lone pair of electrons on the nitrogen atom gets delocalized over the benzene ring and thus it is less easily available for protonation.
- Therefore, aromatic amines are weaker bases than ammonia and aliphatic amines.
- Aromatic amines are more stable than corresponding protonated ion; Hence, they have very less tendency to combine with a proton to form corresponding protonated ion, and thus they are less basic.

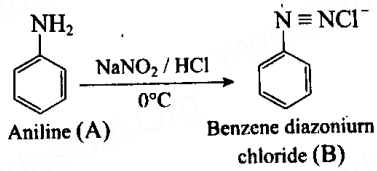
12.What happens when nitrous acid reacts with (i) Ethyl amine (ii) Aniline (iii) N-methylamine (iv) Trimethyl amine (v) N , N – dimethyl aniline



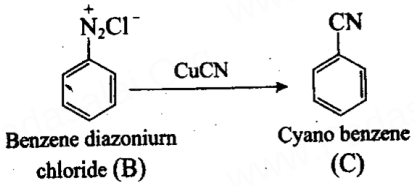
Problems

1.An organic compound (A) of molecular formula C_6H_7N on reaction with sodium nitrite and hydrochloric acid gives (B) .(B) on treatment with cuprous cyanide gives (C) of molecular formula C_7H_5N .(C) on reaction with sodium and ethanol gives (D) of formula C_7H_9N . (D) on reaction with nitrous acid gives (E) of molecular formula C_7H_8O . Identify A, B , C , D and E

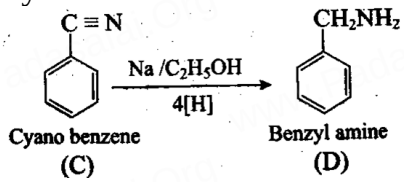
Aniline reacts with sodium nitrite and hydrochloric acid gives Benzene diazonium chloride



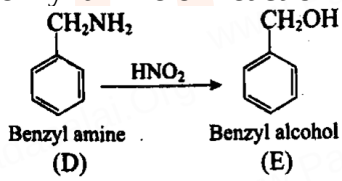
Benzene diazonium chloride on treatment with cuprous cyanide gives cyanobenzene



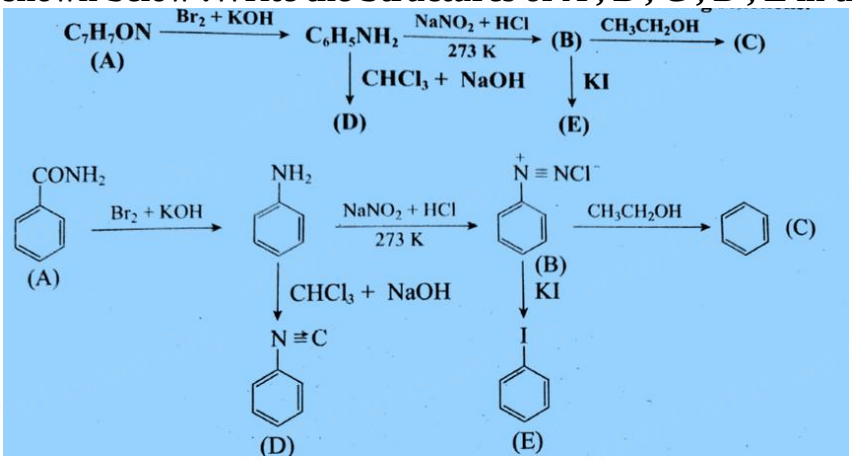
Cyanobenzene on reaction with sodium and ethanol gives Benzylamine



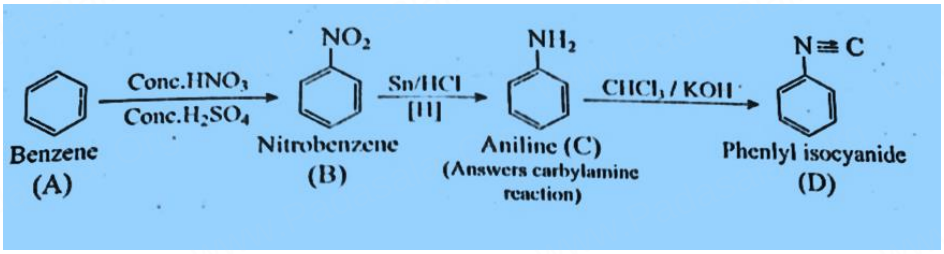
Benzyl amine on reaction with nitrous acid gives Benzyl alcohol



2.An aromatic compound A of molecular formula C_7H_7ON undergoes a series of reaction as shown below .Write the Structures of A , B , C , D , E in the following reaction



3.An aromatic compound (A) of molecular formula C_6H_6 on reaction with Conc HNO_3 and Conc. H_2SO_4 gives (B) .(B) on treatment with Sn/HCl gives (C) of molecular formula C_6H_7N .(C) which answers carbylamine. (C) on reaction with Chloroform and alkali gives (D). Identify A, B , C , D



Unit – 14 Biomolecules

1. Which among the following is called fruit sugar?
a) Glucose **b) Fructose**
c) Sucrose d) Maltose

2. Disaccharides have general formula
a) $C_n(H_2O)_n$ b)$(CO_2)_nH_n$
c) $C_n(H_2O)_{n-1}$ d) $C_n(H_2O)_{2n-1}$

3. Name the base present only in RNA
a) adenine b) guanine
c) uracil d) thymine

4. Which is a monosaccharide among the following?
a) sucrose b) cellulose
c) maltose **d) glucose**

5. Identify the reducing sugar.
a) sucrose b) cellulose
c) starch **d) glucose**

6. Sucrose is not
a) a di-saccharide
b) a non-reducing sugar
c) hydrolysed to only glucose
d) hydrolysed to glucose and fructose

7. Inversion of sucrose refers to
a) oxidation of sucrose
b) reduction of sucrose
c) hydrolysis of sucrose to glucose and fructose
d) polymerization of sucrose.

8. The amino acid without chiral carbon is.
a) Glycine b) Alanine
c) Proline d) Tyrosine

9. The building block of proteins are
a) α – hydroxy acids
b) α – amino acids
c) β – hydroxy acids
d) β – amino acids

10. Denaturation does not involve
a) breaking up of H – bonding in proteins.
b) the loss of biological action of enzyme.
c) the loss of secondary structure.
d) loss of primary structure of proteins.

11. Ultimate products of hydrolysis of proteins is
a) aniline b) aliphatic acid
c) amino acid d) aromatic acid

12. Which contains a long chain ester?
a) Wax b) Cooking oil
c) Turpentine oil d) Cellulose

13. Hair and Nail contains
a) cellulose b) fat
c) keratin d) lipid

14. Fructose on reduction with HI/P gives
a) n-hexane b) iso-hexane
c) 1˚ alcohol d) no reaction

15. Starch when heated with enzyme diastase yields
a) glucose b) sucrose
c) maltose d) glycogen

16. Carbohydrates are
a) polyhydroxy aldehydes
b) polyhydroxy ketones
c) polyhydroxy acids
d) both (a) and (b)

17. sugars that yield two to ten monosaccharide molecules on hydrolysis is
a) monosaccharides b) disaccharides
c) oligosaccharides d) polysaccharides

18. The number of primary and secondary alcoholic groups in fructose is
a) 2,3 b) 3,2 c) 4,3 d) 5,4

19. Fructose is not oxidised by bromine water indicates
a) the presence of aldehydic group
b) presence of ketonic group
c) absence of aldehydic group
d) absence of ketonic group

20. The amino acids that are synthesized by the tissues of the body are called
a) essential amino acid
b) non essential amino acid.
c) zwitter ion
d) none of the above

21. Glucose + acetic anhydride $\xrightarrow{Pyridine}$?
a) di acetate b) tetra acetate
c) penta acetate d) hexa acetate

22. Which of the following polysaccharide is found in the liver and muscles of animals?
a) cellulose **b) glycogen**
c) starch d) heparin

23. The disaccharide found in milk of mammals and referred as milk sugar is _____
a) Lactose b) Engthrose
c) Galactose d) Erythrulose

24. Sprouting barley is the main source of _____ sugar.
a) glucose b) fructose
c) cellulose **d) maltose**

25. Starch contains 20% of _____ and 80% of _____.
a) ribulose , amylose
b) mylopectin , amylose
c) amylose , amylopectin
d) amylopectin , ribulose

26. _____ enzyme catalyses the hydrolysis of sucrose.
a) glycosidase b) cellulose
b) lactase **d) Sucrase**

27. Deficiency of vitamin D causes_____.
a) neurological dysfunction
b) pellagra
c) Beri - Beri **d) Rickets**

28. The general formula of carbohydrates is _____.
a) $C_n(H_2O)$ **b) $C_n(H_2O)_n$**
c) $C(H_2O)_n$ d) $H(CO_2)$

29. Honey is a mixture of _____.
a) glucose and fructose
b) glucose, fructose and sucrose
c) glucose and galactose
d) glucose, fructose and galactose

30. _____ acts as a shock absorber and lubricant.
a) glycogen b) Ribose
c) starch **d) hyaluronate**

31. The vitamin used in the building of collagen is_____.
a) vitamin A **b) vitamin C**
c) vitamin E d) vitamin K

32. Vitamin B_2 is called _____.
a) Retinol b) folic acid
c) Ascorbic acid **d) Riboflavin**

33. A mixture of D (+) glucose and D (-) fructose is known as _____.
a) cane sugar b) sweetless sugar
c) invert sugar d) starch sugar

34. The number of asymmetric carbon atoms present in glucose and fructose are _____.
a) 3,4 **b) 4,3** c) 4,5 d) 5,4

35. The precipitation of protein is called _____.
a) peptisation **b) denaturation**
c) renaturation d) none of these

36. Sorbitol and Mannitol are _____.
a) isomers b) polymers
c) epimers d) dimers

37. What is the proportion of hydrogen and oxygen in molecule of all member of carbohydrate ?
a)2:1 b) 1:1
c) 1:2 d) no certain ratio

38. Which carbohydrate isn't soluble in water and tasteless ?
a)monosaccharide b) trisaccharide
c) oligosaccharide **d) none of above**

39. which carbon is anomeric carbon in cyclic structure of glucose?
a)C_1 b) C_2 c) C_3 d) C_4

40.Which is non-reducing sugar?
a)glucose b) fructose
c) sucrose d) A&B both

41. On hydrolysis of which substance, we obtain two molecules of glucose?
a)sucrose **b) maltose**
c) lactose d)A&B

42. By which bond the polypeptide chains are held together in fibrous protein ?
a)hydrogen bond b) covalent bondc) disulphide bond **d) A&C**

43. Which vitamin isn't synthesizes from vegetable?
aCyanocobalamine b) pyridoxine
c)thiamine d) Tocopherol

44. Which vitamin's source is yeast?
a)B_1 b) H c) B_6 d) all

45. By which bond , base of one nucleotide and base of another nucleotide are joined together ?
a)hydrogen bond b) covalent bond
c) coordination covalent bond d) ionic

46.How many hydrogen bonds between base G and Base C are present in structure of DNA ?
a)1 b) 2 **c) 3** d) no certain number

47.If a person bleeds by his gingiva , so what would you suggest to eat to prevent the disease ?
a)vegetable oil **b) citrus fruits**
c) cheese d) milk

48. Glucose is known as glucopyranose because
a)cyclic structure of glucose contains 6 member ring
b)cyclic structure of glucose contains 5 carbon atoms and one oxygen atoms
c)glucose is aldohexose
d) glucose is ketohexose

49. Essential amino acid is
a)valine b)histidine
c)methionine **d)all**

Short Answer

1. What type of linkages hold together monomers of DNA?

Phosphoric acid forms phosphor diester bond between nucleotides.
Nucleotides are linked in DNA and RNA by phosphodiester bond between 5' OH group of one nucleotide and 3' OH group on another nucleotide.

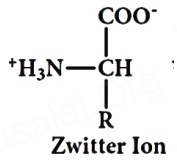
2. Give the differences between primary and secondary structure of proteins

Primary structure of proteins	Secondary structure of proteins
Linear sequence of amino acids.	Folding of the peptide chain into an α-helix and β-helix.
Composed of peptide bonds formed between amino acids.	Encompasses hydrogen bonds.
Formed during translation.	Forms collagen ,elastin actin ,myosin and keratin -like fibres.
Involved in post-translational modifications.	Involved in forming structures such as cartilages,ligaments,skins etc.

3. **Name the Vitamins whose deficiency cause i) rickets ii) scurvy**

(i)Vitamin-D deficiency - Rickets
(ii)Vitamin-C deficiency - Scurvy diseases.

4. Write the Zwitter ion structure of alanine



Zwitter Ion

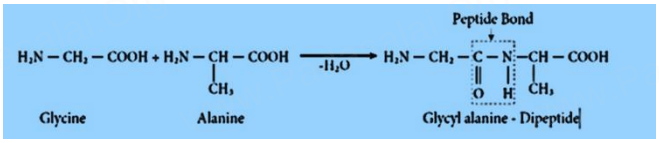
5. **Give any three difference between DNA and RNA**

DNA	RNA
It mainly present in nucleus,mitochondria and chloroplast.	It mainly present incytoplasm and nucleolus and ribosomes.
It contains deoxyribose sugar.	It contains ribose sugar.
Double stranded molecules.	Single stranded molecules.
It 's life time is high.	It is short lived.
It can replicate itself.	It cannot replicate itself,It formed from DNA

6. **Write a short note on peptide bond**

(i) The amino acids are linked covalently by peptide bonds.

(ii)The carbonyl group of the first amino acid react with the amino group of the second amino acid to give an amide linkages(-CONH) between these amino acids.This amide linkages is called peptide bond.



(iii) The resulting compound is called a dipeptide.Because two amino acids are involved for getting one peptide bond.

(iv)If large number of amino acids combined through peptide bond the resulting gaint molecule is called a protein.

(v)The amino end of the peptide is known as N-terminal,while the carboxy end is called C-terminal.

7. Give two difference between Hormones and vitamins

Hormones	Vitamins
Hormones are produced in the endocrine or ductless glands.	Vitamins(except vitamin-D) are not produced in the body.Vitamin must be supplied in the diet.
Hormones are not stored in the body.These are produced as and when required.	Vitamin are stored in the body upto certain extent.
Hormones have no catalytic action.	Vitamin have catalytic reaction.
Deficiency causes metabolic disorders	Their deficiency or excess causes diseases.

8. Write a note on denaturation of proteins

(i)In general protein has a unique three dimensional structure formed by interactions such as disulphide bond,hydrogen bond,hydrophobic and electrostatic interactions.

(ii)These interactions can be disturbed when the proteins is exposed to high temperature in certain chemicals such urea,alteration of pH,ionic strength etc. It leads to the loss of three dimensional structure.

(iii)The process of protein losing its high order structure without losing the primary structure it is called denaturation of proteins.When a protein denatures,its biological function is also lost.

(iv)Since the primary structure is intact,the process can be reversed in certain proteins.this can happen spontaneously upon restoring the original conditions or with help of special enzymes called cheperons.

Example: Coagulation of egg white by action of heat.

9. What are reducing and non – reducing sugars?

(i) **Reducing sugars**: Those carbohydrates which contain free aldehyde or ketonic group and reduces Fehling's solution and Tollen's reagent are called reducing sugar.
Eg: All monosaccharides whether aldose or ketone are called reducing sugars.

(ii)**Non reducing sugars:** Carbohydrates which do not reduce Fehling's solution and Tollen's reagent are called non reducing sugars.
Eg: Sucrose.They do not have free aldehyde group.

10. Why carbohydrates are generally optically active.

Carbohydrates are generally active because they have one or more chiral carbon atoms in their molecules.

11. Classify the following into monosaccharides, oligosaccharides and polysaccharides. i) Starch ii) fructose iii) sucrose iv) lactose iv) maltose

i)Starch- polysaccharides

ii)Fructose- monosaccharides
iii)Sucrose- oligosaccharides
iv)Lactose- oligosaccharides
v)Maltose- oligosaccharides

12. How are vitamins classified

Vitamins are classified into two groups based on their solubility in water and in fat.

Fat soluble vitamins:

- These vitamins absorbed best when taken with fatty food and are stored in fatty tissues and livers.
- These vitamins do not dissolve in water. Hence they are called fat soluble vitamins. Vitamin **A, D, E & K** are fat-soluble vitamins.

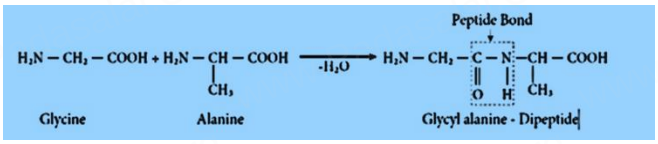
Water soluble vitamins: Vitamins **B (B_1, B_2, B_3, B_5, B_6, B_7, B_9 & B_{12}) and C** are readily soluble in water. On the contrary to fat soluble vitamins, these can't be stored.

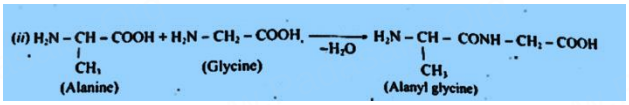
13. What are hormones? Give examples

- Hormones is an organic substance that is secreted by one tissue into blood stream and induces phsycological responses in other tissues.
- It is an inter cellular signalling molecule.
- Virtually every process is complex organismis regulated by one or more hormones.

Example: Insulin, Epinephrine, Oestrogen and androgen.

14. Write the structure of all possible dipeptides which can be obtained form glycine and alanine





15. Define enzymes

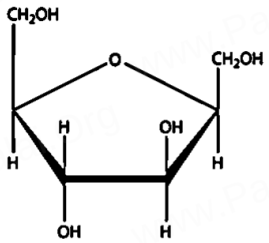
Enzymes are biocatalyst produced by the living cells which catalyse many biochemical reaction in animal and plant bodies .

Or

Digestion of food and harvesting the energy from them and synthesis of necessary molecules required for various cellular functions are example for such reactions.

All these reactions are catalysed by such proteins called enzymes.

16. Writhe the structure of D (+) glucopyranose



α-D-Fructose

(α–D-Fructofuranose)

17. What are different types of RNA which are found in cell

RNA molecules are classified according to their structure and function into three major types

i. Ribosomal RNA (rRNA)
ii. Messenger RNA (mRNA)
iii. Transfer RNA (tRNA)

r-RNA

- r-RNA is mainly found in cytoplasm and in ribosomes, which contain 60% RNA and 40%protein.
- Ribosomes are the sites at which protein synthesis takes place.

t-RNA

- t-RNA molecules have lowest molecular weight of all nucleic acids.
- They consist of 73 – 94 nucleotides in a single chain.
- The function of tRNA is to carry amino acids to the sites of protein synthesis on ribosomes.

mRNA

- m-RNA is present in small quantity and very short lived.
- They are single stranded, and their synthesis takes place on DNA.
- The synthesis of m-RNA from DNA strand is called transcription.
- m-RNA carries genetic information from DNA to the ribosomes for protein synthesis

18. Write a note on formation of α-helix

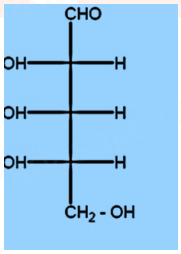
In the α-helix sub-structure, the amino acids are arranged in a righthanded helical (spiral) structure and are stabilised by the hydrogen bond between the carbonyl oxygen one amino acid (n^{th} residue) with amino hydrogen of the fifth residue ($n+4^{th}$ residue).

- The side chains of the residues protrude outside of the helix.
- Each turn of an α-helix contains about 3.6 residues and is about 5.4 A long.
- The amino acid proline produces a kink in the helical structure and often called as a helix breaker due to its rigid cyclic structure.

19. What are the functions of lipids in living organism.

1. Lipids are the integral component of cell membrane. They are necessary of structural integrity of the cell.
2. The main function of triglycerides in animals is as an energy reserve. They yield more energy than carbohydrates and proteins.
3. They act as protective coating in aquatic organisms.
4. Lipids of connective tissue give protection to internal organs.
5. Lipids help in the absorption and transport of fat soluble vitamins.
6. They are essential for activation of enzymes such as lipases.
7. Lipids act as emulsifier in fat metabolism

20. Is the following sugar, D – sugar or L – sugar?



L-sugar

Book inside Two Marks

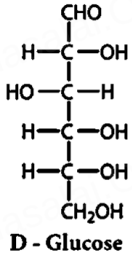
1.Define carbohydrates.Give example.

(i)Carbohydrates are defined as polyhydroxy aldehydes or ketoses with general formula $C_n(H_2O)_n$

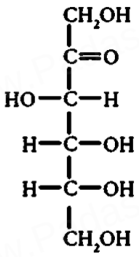
(ii)They are considered as hydrates of carbon containing hydrogen and oxygen in the same ratio as in water.

Example : glucose,sucrose,cellulose.

2.Draw the structure of (i)D-Glucose (ii) D-fructose

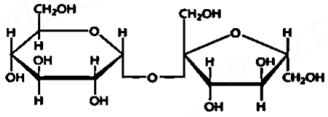


D - Glucose



D - Fructose

3.Draw the structure of sucrose.

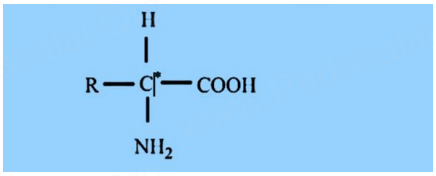

Sucrose

4.Write note about glycogen?

- It is the storage polysaccharide of animals. It is present in the liver and muscles of animals. Glycogen is called animal starch.
- Glycogen on hydrolysis gives glucose molecules .Structurally glycogen resembles amlyo pectin with more branching .In glycogen the branching occurs every 8-14 glucose units opposed to 24-30 units in amylopectin. The excessive glucose in the body stored in the form of glycogen.

5.What are amino acids ?Give its structure

- Amino acids are compounds which contain an amino group and a carboxylic acid group.
- Protein molecules are made up of
- α- , -γ-, δ- etc.amino acids.
- The protein molecules are made up α-amino acids which can be represented by the following general formula

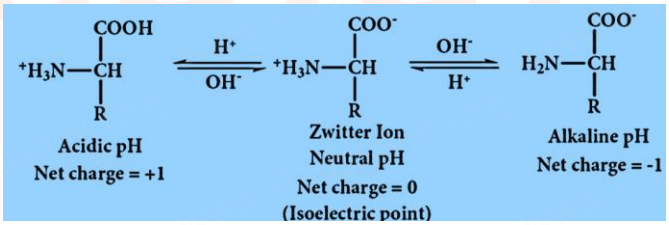


6.Define an iso electric point.

- At a specific pH value the net charge of an amino acid in neutral is called iso electric point.
- At a pH value above the isoelectric point the amino acid will be negatively charged and positively charged at pH values below the iso electric point.

7.What is Zwitter ion? Give its structure

- At aqueous solution the proton from carboxyl group can be transferred to the amino group of an amino acid leaving these groups with opposite charges. Despite having both positive and negative
- charges this molecule is neutral and has amphoteric behaviour. These ions are called zwitter ions.



8.**What are essential and non essential amino acids ?Give two examples of each type.**

Essential amino acids: Amino acids which cannot be synthesised in the body and must be obtained through regular diet are known as essential amino acids.

Example: Valine,Leucine

Non Essential amino acids: The amino acids which can be synthesised in the body

by itself are known as non essential amino acids.
Example: Glycine,Alanine.

9.Name the four bases present in DNA. Which one of these not present in RNA?

- DNA contain four bases Adenine(A),guanine(G),cytosine(C),
- thymine(T)
- RNA also contain four bases ,first three bases are same as in DNA but the fourth one is uracil(U).

10.Why vitamin C cannot be stored in body?

- Vitamin B and C are water soluble and hence cannot be stored in our body
- .The excess vitamins will be excreted through urine and hence these two vitamins should be supplied regurarly to our body.

11.Name the two types of nucleic acids.

- Two types of nucleic acids are Deoxyribonucleic acid (DNA)
- Oxyribonucleic acid (RNA).

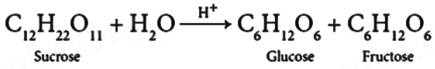
12.What is mutarotation?

When pure form any one of these sugars dissolved in water, slow interconversion of α-D glucose and β-D glucose via open chain form until equilibrium is established giving constant specific rotation + 53° This phenomenon is called **mutarotation**.

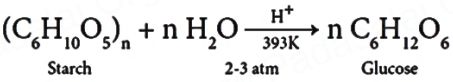
Book inside - 3 Marks

1.Explain the methods of preparation of glucose.

1. When sucrose (*cane sugar*) is boiled with dilute H_2SO_4 in alcoholic solution, undergo hydrolysis and give glucose and fructose.

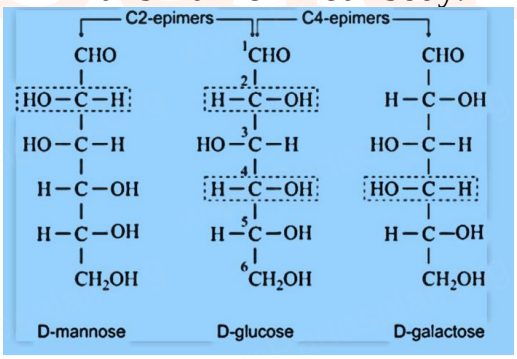


2. Glucose is produced commercially by the hydrolysis of starch with dilute HCl at high temperature under pressure.



2.Define (i)Epimers (ii) Epimersation

1) Sugar differing in configuration at an asymmetric centre is known as epimers.
2) The process by which one epimer is converted into other is called epimerisation and it requires the enzymes epimerase.
3) Galactose is converted to glucose by this manner in our body.



Glucose and mannose ate epimers at C_2 carbon and glucose and galactose are epimers at C_4 carbon.

3.Explain about the structures ,nature and properties of sucrose.

- Sucrose commonly known as table sugar is the most abundant disaccharide.

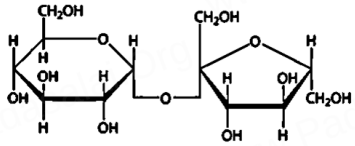
- It is obtained mainly from the juice of sugar cane and sugar beets. Insects such as honey bees have the enzyme called invertases that catalyzes the hydrolysis of sucrose to a glucose and fructose
- mixture.
- Honey in fact, is primarily mixture of glucose, fructose and sucrose.
- On hydrolysis sucrose yields equal amount of glucose and fructose units.

$$sucrose \xrightarrow[H_2O]{\text{Invertase}} Glucose + Fructose$$

- Sucrose (+66.6°) and glucose (+52.5°) are dextrorotatory compounds while fructose is levorotatory (-92.4°).
- During hydrolysis of sucrose the optical rotation of the reaction mixture changes from dextro to levo.
- Hence, sucrose is also called as invert sugar.

Structure:

- In sucrose, C_1 of α-D-glucos is joined to C_2 of -D-fructose.
- The glycosidic bond thus formed is called α-1,2 glycosidic bond.
- Since, the both the carbonyl carbons (reducing groups) are involved in the glycosidic bonding, sucrose is a non-reducing sugar.



Sucrose

(α-D-glucopyranosyl-β-D-fructofuranoside)

4.Prove that sucrose is (i) invert sugar (ii)non reducing sugar.

Sucrose is an invert sugar:

- Sucrose ($+66.6^0$) and glucose ($+52.5^0$) are dextrorotatory compounds while fructose is levo rotatory (-92.4^0).
- During hydrolysis of sucrose the optical rotation of the reaction mixture changes from dextro to levo .Hence sucrose is called as invert sugar.

Non reducing sugar

- In sucrose ,C_1 of α-D glucose is joined to C_2 of D-fructose .The glycosidic bond thus formed is called α-1,2 glycosidic bond.
- Since the both the carbonyl carbons(reducing groups) are involved in the glycosidic bonding ,sucrose is a non reducing sugar.

5.What are the uses of cellulose?

Cellulose is used extensively in manufacturing paper, cellulose fibres, rayon explosive, (Gun cotton – Nitrated ester of cellulose) and so on.

6.Human cannot use cellulose as food Why?

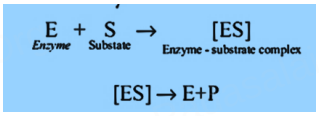
- Human cannot use cellulose as food because our digestive system do not contain the necessary enzymes such as glycosidases or cellulases that can hydrolyse the cellulose.
- But animals contains cellulose enzyme in their digestive sytem and they can digest cellulose . so cellulose can use as food for animals not for human.

7.Explain the mechanism of enzyme action?

Enzymes are biocatalysts that catalyse a specific biochemical reaction.

They generally activate the reaction by reducing the activation energy by stabilising the transition state.

In a typical reaction enzyme E binds with the substrate molecule reversibly to produce an enzyme substrate complex. During this stage the substrate is converted into product and the enzyme becomes free and is ready to bind to another substrate molecule.



8.Explain about the nature classification and properties of lipids

- Lipids are organic molecules that are soluble in organic solvents such as chloroform and methanol and are insoluble in water.
- There are the principal components of cell membranes including cell walls.
- In addition, they also act as energy source for living systems. Fat provide 2-3 fold higher energy compared to carbohydrates or proteins.

Classification of lipids:

- Based on their structures Lipids can be classified as **simple lipids, compounds lipids and derived lipids**.
- Simple lipids can be further classified into fats, which are esters of long chain fatty acids with glycerol (triglycerides) and waxes which are the esters of fatty acids with long chain monohydric alcohols (Bees wax).
- Compounds lipids are the esters of simple fatty acid with glycerol which contain additional groups.
- Based on the groups attached, they are further classified into phospholipids, glycolipids and lipoproteins.
- Phospholipids contain a phospho-ester linkage while the glycolipids contain a sugar molecule attached.
- The lipoproteins are complexes of lipid with proteins.

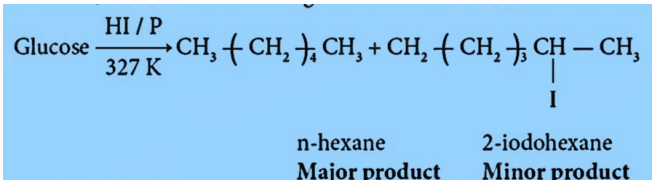
9.Differences between globular and fibrous proteins.

Globular proteins	Fibrous proteins
They form α-helix structure.	They have β-pleated structure.
They are soluble in water.	They are insoluble in water.
They are cross lined condensation polymers of acidic and basic amino acids.	They are linear condensation polymeric proteins.

10.Explain what is meant by (i) a peptide linkage (ii) a glycosidic linkage.

(i)**Peptide linkage:**

Polymers of x-amino acids are connected to each other by peptide bond or peptide linkage.



(ii)**Glycosidic linkage:**
The two monosaccharide units are joined together by an oxide linkage formed by the loss of water molecule.Such a linkage between two monosaccharides units through oxygen atom is called glycosidic linkage.

11.Explain the classification of proteins based on their structure.

- Proteins are classified based on their structure (overall shape) into two major types.
- They are fibrous protein and globular proteins.
- Fibrous proteins are linear molecules similar to fibres. These are generally insoluble in water and are held together by disulphide bridges and weak intermolecular hydrogen bonds.
- The proteins often used as structural proteins.
- **Example:** Keratin, Collagen etc…
- Globular proteins have an overall spherical shape.
- The polypeptide chain is folded into
- a spherical shape.
- These proteins are usually soluble in water and have many functions
- including catalysis.

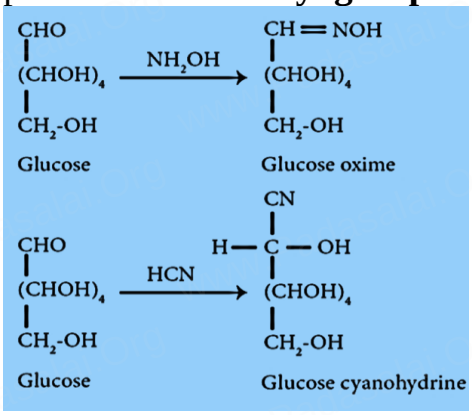
Book inside -5 Marks

1.How would you prove that structure of glucose ?(OR) Elucidate the structure of glucose.

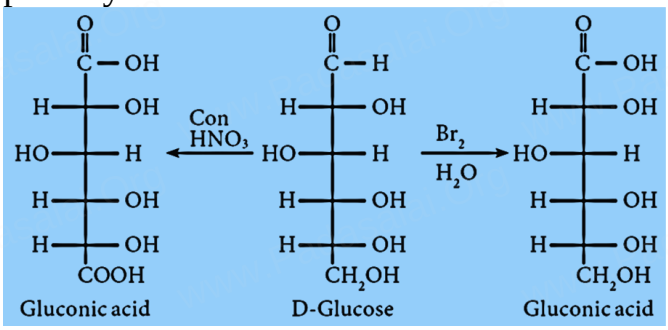
1. Elemental analysis and molecular weight determination show that the molecular formula of glucose is $c_6H_{12}O_6$

2. On reduction with concentrated HI and red phosphorus at 373K, glucose gives a mixture of n hexane and 2, iodohexane indicating that the **six carbon atoms are bonded linearly**.

3. Glucose reacts with hydroxylamine to form **oxime** and with HCN to form **cyanohydrin**. These reactions indicate the presence of **carbonyl group** in glucose.

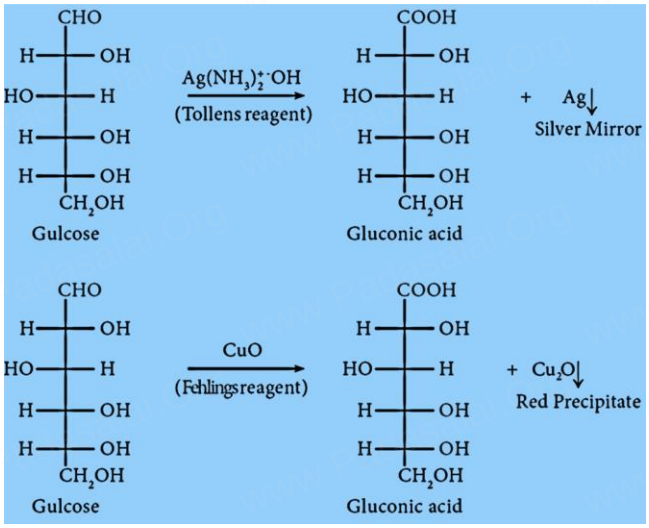


4. Glucose gets oxidized to gluconic acid with mild oxidizing agents like bromine water suggesting that the carbonyl group is an aldehyde group and it occupies one end of the carbon chain. When oxidised using strong oxidising agent such as conc. Nitric acid gives glucaric acid (saccharic acid) suggesting the other end is occupied by a primary alcohol.

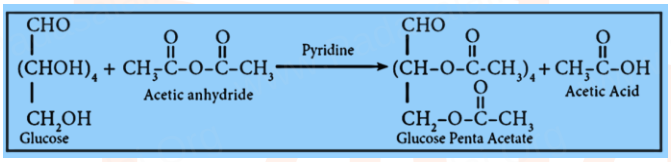


5. Glucose is oxidised to gluconic acid with ammonical silver nitrate (Toller's reagent) and alkaline copper sulphate (Fehling's solution). Toller's reagent is reduced to metallic silver and Fehlings solution to cuprous oxide which appears as red precipitate. These reactions

further confirm **the presence of an aldehyde group.**

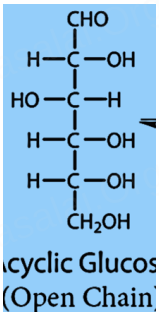


6. Glucose forms penta acetate with acetic anhydride suggesting the presence of **five alcohol groups.**



7. Glucose is a stable compound and does not undergo dehydration easily. It indicates that not more than one hydroxyl group is bonded to a single carbon atom.
Thus the five the hydroxyl groups are attached to five different carbon atoms and the sixth carbon is an aldehyde group.

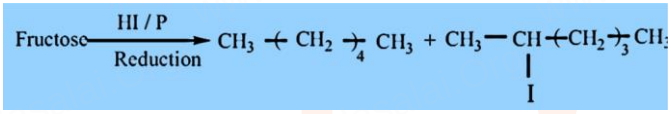
8.The exact special arrangement of -OH groups was given by Emil Fischer as follows



2.**Explain the structure of Fructose**

1. Elemental analysis and molecular weight determination of fructose show that it has the molecular formula **$C_6H_{12}O_6$**

2. Fructose on reduction with HI and red phosphorus gives a mixture of n – hexane (major product) and 2 – iodohexane (minor product). This reaction indicates that the six carbon atoms in fructose are in a straight chain.



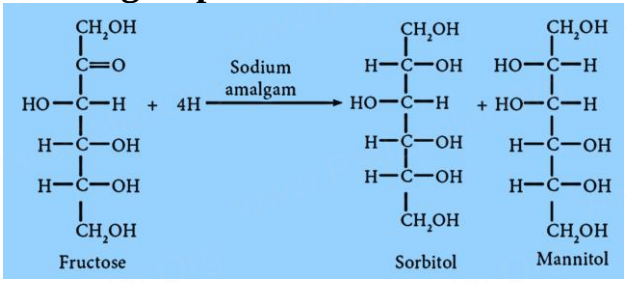
3. Fructose reacts with NH_2OH and HCN. It shows the **presence of carbonyl groups** in the molecule of fructose.

4. Fructose reacts with acetic anhydride in the presence of pyridine to form penta acetate. This reaction indicates the **presence of five hydroxyl groups** in a fructose molecule.

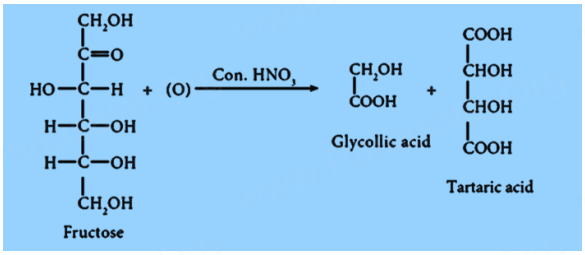
5. Fructose is not oxidized by bromine water. This rules out the possibility of presence of an aldehyde (-CHO) group.

6. Partial reduction of fructose with sodium amalgam and water produces mixtures of sorbitol and mannitol which are epimers at second carbon. New asymmetric carbon is

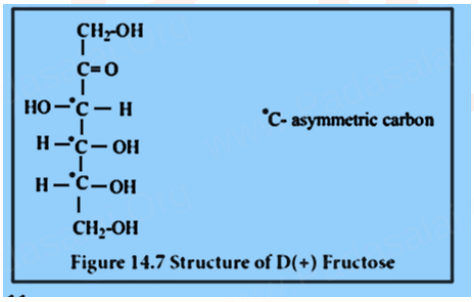
formed at C-2. This confirms the **presence of keto group.**



7. On oxidation with nitric acid, it gives glycolic acid and tartaric acids which contain smaller number of carbon atoms than in fructose.



This shows that a keto group is present in C-2. It also shows the presence of 1°alcoholic groups at C- 1 and C- 6.

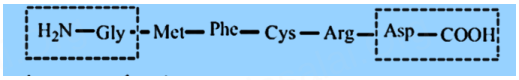


3.Explain about the structure of proteins.

- Proteins are polymers of amino acids. Their three dimensional structure depends mainly on the sequence of amino acids (residues).
- The protein structure can be described at four hierarchal levels called primary, secondary, tertiary and quaternary structures

Primary structure of proteins:

- Proteins are polypeptide chains made up of amino acids connected through peptide bonds.
- The relative arrangement of the amino acids in the polypeptide chain is called the primary structure of the protein.



Secondary structure of proteins:

The amino acids in the polypeptide chain forms highly regular shapes (sub-structures) through the hydrogen bond between the carbonyl oxygen (-C=O) and the neighbouring amine hydrogen (-NH)of the main chain.α-Helix and β-strands or sheets are two most common substructures formed by proteins.

α-Helix

- In the α-helix sub-structure, the amino acids are arranged in a righthanded helical (spiral) structure and are stabilised by the hydrogen bond between the carbonyl oxygen one amino acid (n^{th} residue) with amino hydrogen of the fifth residue ($n+4^{th}$ residue).
- The side chains of the residues protrude outside of the helix. Each turn of an α-helix contains about 3.6 residues and is about 5.4 A long.
- The amino acid proline produces a kink in the helical structure and often called as a helix breaker due to its rigid cyclic structure.
- β-Strands are extended peptide chain rather than coiled.
- The hydrogen bonds occur between main chain carbonyl group one such strand and the amino group of the

adjacent strand resulting in the formation of a sheet like structure.
- This arrangement is called β-sheets.

3. Tertiary structure:
- The secondary structure elements (α-helix&β-sheets) further folds to form the three dimensional arrangement.
- This structure is called tertiary structure of the polypeptide (protein).
- Tertiary structure of proteins are stabilised by the interactions between the side chains of the amino acids.
- These interactions include the disulphide bridges between cysteine residues, electrostatic, hydrophobic, hydrogen bonds and van der Waals interactions.

4. Quaternary Structure
- Some proteins are made up of more than one polypeptide chains.
- For example, the oxygen transporting protein,
- heamoglobin contains four polypeptide chains while DNA polymerase
- enzyme that make copies of DNA, has ten polypeptide chains.
- In these proteins the individualpolypeptide chains (subunits) interacts with each other to form the multimeric structure
- which known as quaternary structure.
- The interactions that stabilises the tertiary structures also stabilises the quaternary structures.

4.What are the biological importance of proteins?

1. All biochemical reactions occur in the living systems are catalysed by the catalytic proteins called enzymes.

2. Proteins such as keratin, collagen acts as structural back bones.
3. Proteins are used for transporting molecules (Haemoglobin), organelles (Kinesins) inthe cell and control the movement of molecules in and out of the cells (Transporters).
4. Antibodies help the body to fight various diseases

5. Proteins are used as messengers to coordinate many functions. Insulin & glucagon controls the glucose level in the blood

6. Proteins act as receptors that detect presence of certain signal molecules and activate
the proper response.

7. Proteins are also used to store metals such as iron (Ferritin) etc

5.Explain about the composition acids.

Nucleic acids are biopolymers of nucleotides. Controlled hydrolysis of DNA and RNA yields three components namely a nitrogenous base, a pentose sugar and phosphate group.

Nitrogen base
- These are nitrogen containing organic compounds which are derivatives of two parent compounds, pyrimidine and purine. Both DNA and RNA have two

major purine bases, adenine (A) and guanine (G). In both DNA and RNA, one of the pyrimidines is cytosine (C),
- but the second pyrimidine is thymine (T) in DNA and uracil (U) in RNA.

Pentose sugar:
- Nucleic acids have two types of pentoses. The recurring deoxyribonucleotide units of DNA contain 2'-deoxy-D-ribose and the ribonucleotide units of RNA contain D-ribose.
- In nucleotides, both types of pentoses are in their β-furanose (closed five membered rings) form.

Phosphate group
- Phosphoric acid forms phosphor diester bond between nucleotides.
- Based on the number of phosphate group present in the nucleotides, they are classified mono nucleotide, dinucleotide
- and trinucleotide.

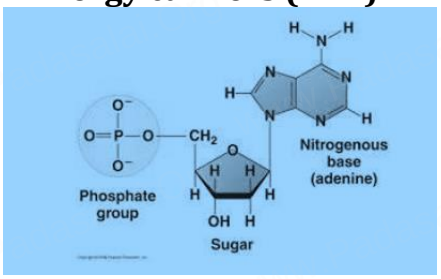
Nucleosides and nucleotides:
- The molecule without the phosphate group is called a nucleoside. A nucleotide is derived from a nucleoside by the addition of a molecule of phosphoric acid.
- Phosphorylation occurs generally in the 5' OH group of the sugar. Nucleotides are linked in DNA and RNA by phosphor diester bond between 5' OH group of one nucleotide and 3' OH group on another nucleotide.

6.Explain about DNA Finger printing process.
- Traditionally, one of the most accurate methods for placing an individual at the scene of a crime has been a fingerprint. With the advent of recombinant DNA technology, a more powerful tool is now available: DNA fingerprinting (also called DNA typing or DNA profiling).
- The DNA finger print is unique for every person and can be extracted from traces of samples from blood, saliva, hair etc…
- By using this method we can detect the individual specific variation in human DNA.
- In this method, the extracted DNA is cut at specific points along the strand with restriction enzymes resulting in the formation of DNA fragments of varying lengths which were analysed by technique called gel electrophoresis. This method separates the fragments based on their size. The gel containing the DNA fragments are then transferred to a nylon sheet using a technique called blotting.
- Then, the fragments will undergo autoradiography in which they were exposed to DNA probes (pieces of synthetic DNA that were made radioactive and that bound to the fragments).
- A piece of X-ray film was then exposed to the fragments, and a dark mark was produced at any point where a radioactive probe had become attached.

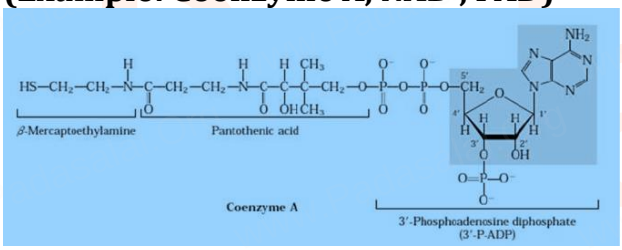
The resultant pattern of marks could then be compared with other samples. DNA fingerprinting is based on slight sequence differences (usually single base-pair changes) between individuals.
These methods are proving decisive in court cases worldwide.

7. Explain about Biological functions of nucleic acids

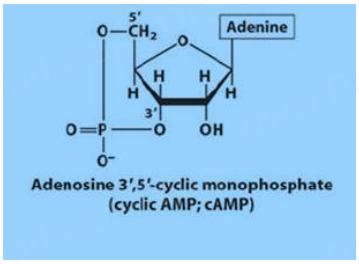
i. Energy carriers (ATP)



ii. Components of enzyme cofactors (Example: Coenzyme A, NAD+, FAD)



iii. Chemical messengers (Example: Cyclic AMP, cAMP)



8.What are the different types of hormones?

Hormones are classified according to the distance over which they act as, endocrine, paracrine and autocrine hormones

Endocrine hormones act on cells distant from the site of their release. Example: insulin and epinephrine are synthesized and released in the bloodstream by specialized ductless endocrine glands.

Paracrine hormones (alternatively, local mediators) act only on cells close to the cell that released them.
For example, interleukin-1 (IL-1)

Autocrine hormones act on the same cell that released them. For example, protein growth factor interleukin-2 (IL-2)

9.Explain about Lactose & maltose

Lactose

- Lactose is a disaccharide found in milk of mammals and hence it is referred to as milk sugar.
- On hydrolysis, it yields galactose and glucose. Here, the β-D–galactose and β-D–glucose are linked by β-1,4 glycosidic bond
- The aldehyde carbon is not involved in the glycosidic bond hence; it retains its reducing property and is called a reducing sugar.

Maltose:

Maltose derives its name from malt from which it is extracted.

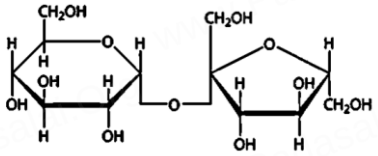
- It is commonly called as malt sugar. Malt from sprouting barley is the major source of maltose.
- Maltose is produced during digestion of starch by the enzyme α-amylase.

- Maltose consists two molecules of α-D-glucose units linked by an α-1,4 glycosidic bond between anomeric carbon of one unit and C-4 of the other unit. Since one of the glucose has the carbonyl group intact it is also acts as a reducing sugar.

10.Distinguish between glucose and fructose.

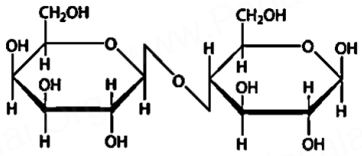
Glucose	Fructose
It contains 4 asymmetric carbon atoms.	It contains 3 asymmetric carbon atoms.
Dextro rotatory	Levo rotatory
Glucose reduces Tollen 's reagent and fehling's solution.	Fructose does not reduce Tollen's reagent and Fehling's solution.
It is aldohexose.	It is keto hexose.
Mild oxidation of glucose with bromine water gives gluconic acid.	Fructose is not oxidised by bromine water.
oxidation of glucose with conc.gives saccharic acid.This indicates the presence of aldehyde	oxidation of fructose with gives a mixture of glycollic and tartaric acid since oxidation occurs with rupture of the carbon chain ,the carbonyl must be present as a ketone group.

11.Draw the structure of sucose , lactose maltose , starch , cellulose



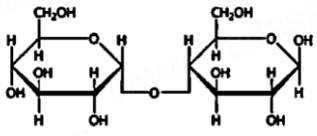
Sucrose

(α-D-glucopyranosyl-β-D-fructofuranoside)



Lactose

(β-D-glucopyranosyl-(1→4)β-D-glucopyranos



Maltose

(α-D-glucopyranosyl-(1→4) α-D-glucopyranose)

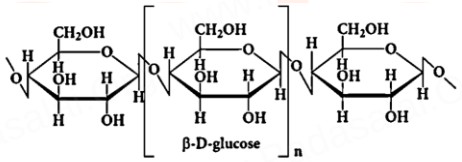
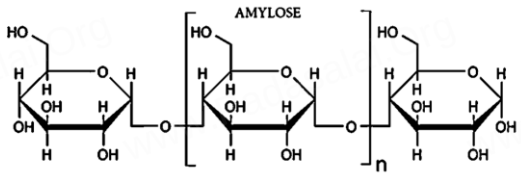


Figure 14.12 Structure of Cellulose



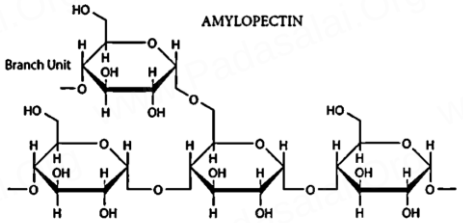


Figure 14.11 Structure of Starch (Amylose & Amylopectin)

12. Describe the Importance of carbohydrates

1. Carbohydrates, widely distributed in plants and animals, acts mainly as **energy sources and structural polymers**.

2. Carbohydrate is stored in the body as **glycogen** and in plant as starch.
3. Carbohydrates such as cellulose which is the primary components of plant cell wall, is used to make paper, furniture (wood) and cloths (cotton)
4. Simple sugar glucose serves as an instant **source of energy**.
5. Ribose sugars are one of the components of **nucleic acids**.
6. Modified carbohydrates such as hyaluronate (glycosaminoglycans) act as **shock absorber and lubricant.**

13.Explain the types of amino acids with their example

- Amino acids can also be classified as essential and non-essential amino acids based on the ability to synthesised by the human.
- The amino acids that can be synthesised by us are called non-essential amino acids **(Gly, Ala, Glu, Asp, Gln, Asn, Ser, Cys, Tyr & Pro)** and those needs to obtained through diet are called essential amino acids **(Phe, Val, Thr, Trp, Ile, Met, His,**
- **Arg, Lys, Thr, Met&Trp)**

13.Describe the Importance of proteins

1. All biochemical reactions occur in the living systems are catalysed by the catalytic proteins called enzymes.
2. Proteins such as keratin, collagen acts as **structural back bones**.
3. Proteins are used for transporting molecules (Haemoglobin), organelles (Kinesins) in the cell and control the movement of molecules in and out of the cells (Transporters).
4. **Antibodies** help the body to fight various diseases
5. Proteins are used as messengers to coordinate many functions. Insulin & glucagon controls the glucose level in the blood
6. Proteins act as receptors that detect presence of certain signal molecules and activate the proper response.
7. Proteins are also used to store metals such as iron (Ferritin) etc

14.Vitamins and their function and deficiency diseases (Disease can be asked in one mark)

Vitamins	Functions	Deficiency diseases
Vitamin A (Retinol)	Vision and growth	Night blindness, Xerophthalmia Keratinisation of skin
Vitamin B_1 (Thiamine)	Co – enzyme in the form of Thiamine pyro phosphate (TPP) in glycolysis	Beri – Beri
Vitamin B_2 (Riboflavin)	Co enzyme in the form of FMN andFAD in redox reactions	Cheilosis
Vitamin B_3 (Niacin)	Co enzyme in the form of NAD and $NADP^+$ in redox reactions.	Pellagra

Vitamin B_5 (Pantothenic acid)	Part of coenzyme A in carbohydrate protein and Fat metabolism	Inadequate growth
Vitamin B_6 (Pyridoxine)	Co enzyme in amino acid metabolism, formation of Heme in Hemoglobin	Convulsions
Vitamin B_7 (Biotin)	Co enzyme in fatty acid Biosynthesis	Depression, Hair loss muscle pain
Vitamin B_9 (Folic acid)	Nucleic acid, synthesis, maturation of red blood cells	Megaloblastic anaemia
Vitamin $B1_2$ (Cobalamin)	Co-enzyme in amino acid metabolism, Red blood cells maturation	Pernicious Anaemia
Vitamin C (Ascorbic acid)	Coenzyme in Antioxidant, building of collagen	Scurvy (bleeding gums)
Vitamin D Cholecalciferol(D3), Ergocalciferol (D2)	Absorption and maintenance of calcium	Rickets (children) , Osteomalacia (adults)
Vitamin E (Tocopherols)	Antioxidant	muscular dystrophy (muscular weakness) and neurological dysfunction
Vitamin K (Phylloquinone& Menaquinones)	Blood clotting	Increased blood clotting time, Haemorrhagic diseases

Mnemonics For Vitamin B – **T**he **R**iver **N**ile **Pa**olo **P**layed for **B**io **F**ootball **C**lub
Example T for Thiamine (B_1)
Mnemonics For Vitamin deficiency disease - KEDAC
He **S**teals **Rick**shaw at **N**ight Dark **S**ky
K – Haemorrhage **E** – sterility **D** – Rickets **A** – Night blindness **C** – scurvy
Beri **Cracks** the floor **Pla**ying with **Papan**
B_1 – Beri beri **B_2** – Cracks in lips **B_3** – Pellagra **B_4** – Acne / Parsthesia **B_6** – Anemia

Don't forgot to study structure of Purine and pyrimidine

12. Describe the structure of DNA.
DNA is a double stranded structure & each strand is a polymer of deoxyribonucleotide. The backbone of the nucleic acid is uniformly consisting of alternating pentose sugar & phosphate group
i)The steps composed of nitrogenous bases adenine guanine cytosine & thymine & hydrogen bonds hold two strands together.
ii)Two strands are complementary to each other.

iii)They run in an antiparallel manner.
iv)It is genetic material in all organisms.
v)It has the property to replicate
vi)At one end of strand, 5-c of pentose sugar is free on other end; third carbon of pentose is free.

13. Glucose or sucrose are soluble in water but cyclohexane or benzene (simple six membered ring compounds) are insoluble in water. Explain.
A glucose molecule contains five -OH groups while a sucrose molecule contains eight -OH groups. Thus, glucose and sucrose undergo extensive H-bonding with water.
Hence, these are soluble in water.
But cyclohexane and benzene do not contain -OH groups. Hence, they cannot undergo H-bonding with water and as a result, are insoluble in water.

14. Why are vitamin A and vitamin C essential to us? Give their important sources.
The deficiency of vitamin A leads to xerophthalmia (hardening of the cornea of the eye) and night blindness. The deficiency of vitamin C leads to scurvy (bleeding gums).
The sources of vitamin A are fish liver oil, carrots, butter, and milk. The sources of vitamin C are citrus fruits, *amla*, and green leafy vegetables.

15. The two strands in DNA are not identical but are complementary. Explain.
In the helical structure of DNA, the two strands are held together by hydrogen bonds between specific pairs of bases. Cytosine forms hydrogen bond with guanine, while adenine forms hydrogen bond with thymine. As a result, the two strands are complementary to each other

UNIT – 15 CHEMISTRY IN EVERYDAY LIFE

STUDY MATERIAL

Unit 15- Chemistry In Everyday Life

Book inside one mark

1. Ampicillin is an example of _____drugs.
a) anaesthetic **b) antibiotic** c) tranquilizer d) none of the above

2. Mental diseases like schizophrenia are treated using _____ drugs.
a) tranquilizers b) antacid c) opioids d) NSAID

3. Which among the following is a modification of penicillin?
a) amoxicillin b) catechaloamine c) crythromycin d) all the above

4. The class of drugs used for the treatment of stress is _____.
a) antihistamine **b) tranquilizens** c) antimicrobials d) aminoglycosides

5. Aspirin is _____.
a) benzoyl salicylic acid **b) acetyl salicylic acid**
c) methyl salicylic d) both (b) and (c)

6. _____ is an antipyretic.
a) quinine **b) paracetamol** c) cephalosporins d) brompheniramine

7. 2–acetoxy benzoic acid is used as an _____.
a) anti malarial b) antihistamine **c) antipyretic** d) antidepressant

8. Which among the following is an ester linked local anaesthetic.
a) procaine b) lidocaine c) both (a) and (b) d) neither (a) nor (b)

9. The drug used in major surgical procedure is_____.
a) procaine b) lidocaine **c) propofol** d) morphine

10. The class of drugs used to slow down the growth of micro organisms in inanimate objects is _____.
a) disinfectants b) antiseptics c) antimicrobials d) narcotic analgesics

11. Sulphur dioxide acts as _____.
a) antimicrobial agents b) antioxidants c) enzyme inhibitors **d) all the above**

12. Oxidation of fats and oils is prevented by _____.
a) BHT (butyl hydroxy toluene) b) BHA (butyl hydroxy anisole)
c) Both (a) and (b) d) neither (a) nor (b)

13. Nylon-66 is an example of _____ polymer.
a) addition **b) condensation** c) both (a) and (b) d) natural

14. Which of the following is not a non-narcotic analgesic?
a) codeine b) acetaminophen c) aspirin d) ibuprofen

15. Zeiglar Natta catalyst is _____.
a) $TiCl_4 + (C_2H_5)_3Al$ b) $-(CF_2 - CF_2)-$ c) $TiCl_4$ d) $(C_2H_5)_3Al$

16. Teflon is an _____ polymer.
a) LDPE **b) HDPE** c) condensation d) all the above

17. The polymer obtained by the condensation of phenol with formaldehyde is _____.
a) Terylene b) Nylon-6 **c) Bakelite** d) Neoprene

18. The free radical polymerisation of the monomer 2 – chloro buta – 1,3 – diene gives

a) Buna N b) Buna S **c) Neoprene** d) PHB

19. The drug that binds to the receptor site and inhibits its natural function are called

a) anomers b) agonists **c) antagonists** d) none of the above

20. _____ is used mainly as preservative for the preparation of pickels.

a) sodium meta bisulphite b) potassium meta bisulphite

c) benzoic acid **d) acetic acid**

21. The quality of a soap is described in terms of _____.

a) LDPE b) HDPE **c) TFM (Total fatty matter)** d) LFM (Low fatty matter)

22. Cellulose is an example of _____ polymer.

a) synthetic **b) Natural** c) semisynthetic d) none of the above

23. _____ is used in the manufacture of hoses and tank linings.

a) Buna-S b) Neo prene c) PHBV **d) Buna-N**

24. The medicine used for curing rabies is called _____.

a) antibacterial **b) antiviral** c) antifungal d) antibiotics

25. Phenacetin is _____.

a) antipyretic b) analgesic c) antibiotic d) antiseptic

26. Drug formulation which provide relief from burning sensation are known as _____.

a) antacids b) antiseptic c) analgen's d) antipyretics

27. Which is not an artificial sweetener is _____.

a) Dulcin b) Nectarin c) Sucralose **d) sodium benzoate**

28. Non stick cookery is made from _____.

a) polythene **b) Teflon** c) PVC d) Terylene

29. Glyptal is a polymer of _____.

a) ethylene glycol and terypthalic acid **b) ethylene glycol and pthalic acid**

c) adipic acid and hexamethelene diamine d) phenol and formaldehyde

30. The monomer unit of natural rubber is _____.

a) cis isoprene b) trans isoprene c) orlon d) capro lactam

31. Which one of the following inhibits the initiation of protein synthesis?

a) streptomycin b) erythromycin c) atenolol d) amlodipine

32. Which one of the following inhibits the bacterial growth?

a) p – amino benzoic acid **b) sulphanilamide** c) folic acid d) sodium benzoate

33. Which of the following is called PABA?

a) p – nitro benzanilic acid b) p – amino butyric acid

c) p – amino benzene sulphonic acid d) p – amido benzene sulphonyl chloride

34. Which of the following is not an example of antacid?

a) Histamine b) cimetidine c) ranitidine **d) erythromycin**

35. Which one of the following is used to treat stress, anxiety, depression, sleep disorder and schizopherenia?

a) Tranquilizer b) antibiotic c) analgesic d) opioids

36. Identify the medicine that is used to treat stress, anxiety, depression and schizopherenia.

a) valium b) cimetidine c) chloroform d) adenosine

37. Which one of the following is used in the prevention of heart attacks?
a) aspirin b) ibuprofen c) paracetamol d) morphine

38. Which of the following are used for post operative pain and pain of terminal cancer?
a) morphine, codeine b) ibuprofen, aspirin
c) methyl salicylate, salicylic acid d) histidine, ranitidine

39. Which one of the following is used to treat urinary tract infection and respiratory infections?
a) doxycycline b) karamycin **c) ciprofloxacin** d) ibuprofen

40. Which one is used as preservatives for fresh vegetables and fruits?
a) Palmitic acid b) Palm oil **c) sodium meta sulphite** d) sulphur dioxide

41. Which method is used to preserve food?
a) pasteurization & irration b) chilling & freezing
c) drying & dehydration **d) all the above**

42. What are the raw materials required for the manufacture of terylene?
a) ethylene glycol + terephthalic acid b) phthalic auhydride + phenol
c) adipic acid + hexamethylene diamine d) phenol + methanol

43. What are the raw materials required to prepare Buna – S rubber?
a) phenol + methanol b) melamine + methanal
c) styrene + butadiene d) adipic acid + methanol

44. The role of phosphate in detergent powder is_____.
a) control pH level of the detergent water mixture.
b) remove Ca^{2+} and Mg^{2+} ions from water that causes hardness of water.
c) provide whiteness to the fabric.
d) more soluble in soft water.

45. Commonly used antiseptic ‘dettol’ is a mixture of _____.
a) O – chloro phenozylenol + terpineol b) O – cresol + terpeneol
c) phenol + terpineol **d) chloroxylenol + terpineol**

Book Back

1. Which chemical is responsible for the antiseptic properties of dettol.

- **Chloroxylenol** and **Terpineol** are the chemicals responsible for the antiseptic properties of Dettol.
- But among these chloroxylenol plays more important role.
- Chloroxylenol is an antiseptic and disinfectant which is used for skin disinfection and cleaning surgical instruments.

2. What are antibiotics?

Antibiotics is a chemical substance produced by one microorganism,that selectively inhibits the growth of another microorganism .

Example : Pencillins and Cephalosporins.

3. Name one substance which can act as both analgesic and antipyretic

- Aspirin (acetylsalicylic acid)is a chemical substance which lowers body temperature (to normal) and also reduces body pain .
- Therfore it acts as both antipyretic and analgesic.

4. Write a note on synthetic detergents

(i)Synthetic detergents are formulated products containing either sodium salts of alkyl hydrogen sulphates or sodium salts of long chain alkyl benzene sulphonic acids. There are three types of detergents.

Anionic detergents-sodium lauryl sulphate.

Cationic detergents- n-hexaadecyltrimethyl ammonium chloride

Non ionic detergents- Pentaerythrityl stearate.

(ii) Synthetic Detergents can be used even in hard water ,while soaps cannot be used in water.

(iii) The cleaning action of detergents are similar to the cleansing action of soaps.

5. How do antiseptics differ from disinfectants?

Antiseptics	Disinfectants
Antiseptics are chemical substances which prevent the growth of micro organism and may even kill them but are not harmfuk to living tissues.	Disinfectants are chemical substances which kill microorganism or stop their growth but harmful to human tissues.
They are generally applied to living tissues such as wounds ,cuts bulks and diseased surface.	Disinfectants are applied to inanimated objects such as floors ,drainage system,instruments etc.
All the antiseptics are disinfectants.	All the disinfectants are not antiseptics.
They are not injected or swallowed.	They can be injected or swallowed.
Example : Povoidone -iodine Benzalkonium-Chloride	**Example:**Alochol ,Chloribe compounds.

6. What are food preservatives?

- Food preservatives are chemical substance are capable of inhibiting ,retarding or arresting the process of fermentation,acidification pr oter decomposition of food by growth of microorganism.

(i)Acetic acid is used mainly as a preservative for preparation of pickle.
(ii)Sodium meta sulphite is used as a preservative for fresh vegetables and fruits.
(iii)Sodium benzoate is used as preservative for juices.

7. Who do soaps not work in hard water?

- Soaps are sodium or potassium salts of long chain fatty acids.
- Hard water contains calcium and magnesium ions.
- When soaps are dissolved in hard water these ions displace sodium or potassium from insoluble calcium or magnesium salts of fatty acids.
- These insoluble salts separate as scum.

8. What are drugs? How are they classified

- A drug is a substance that is used to modify or explore physiological systems or pathological states for the benefit of the recipient. It is used for the purpose of diagnosis, prevention, cure/relief of a disease.
- Drugs are classified based on their properties such as chemical structure, pharmacological effect, target system, site of action etc

Classification based on the chemical structure

- In this classification, drugs with a common chemical skeleton are classified into a single group.
- For example, ampicillin, amoxicillin, methiceillinetc.. all have similar structure and are classified into a single group called penicillin.
- Similarly, we have other group of drugs such as opiates, steroids, catecholamines etc. Compounds having similar chemical structure are expected to have similar chemical properties. However, their biological actions are not always similar.
- For example, all drugs belonging to penicillin group have same biological action, while groups such as barbiturates, steroids etc.. have different biological action.

Classification based on Pharmacological effect

- In this classification, the drugs are grouped based on their biological effect that they produce on the recipient.
- For example, the medicines that have the ability to kill the pathogenic
- bacteria are grouped as antibiotics.
- This kind of grouping will provide the full range of drugs that can be used for a particular condition (disease).

Examples:

Antibiotic drugs: amoxicillin, ampicillin,cefixime,
Antihypertensive drugs: propranolol, atenolol,

Classification based on the target system (drug action)

- In this classification, the drugs are grouped based on the biological system/process, that they target in the recipient.
- This classification is more specific than the pharmacological classification.
- For example, the antibiotics streptomycin and erythromycin inhibit the protein

synthesis (target process) in bacteria and are classified in a same group.

- However, their mode of action is different.
- Streptomycin inhibits the initiation of protein synthesis, while erythromyciprevents the incorporation of new amino acids to the protein.

Classification based on the site of action (molecular target)

- The drug molecule interacts with biomolecules such as enzymes, receptors etc,, which are referred as drug targets.
- This classification is highly specific compared to the others.
- These compounds often have a common mechanism of action, as the target is the same.

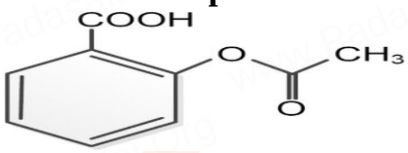
9. How the tranquilizers work in body.

(i)They are neurologically active drugs.

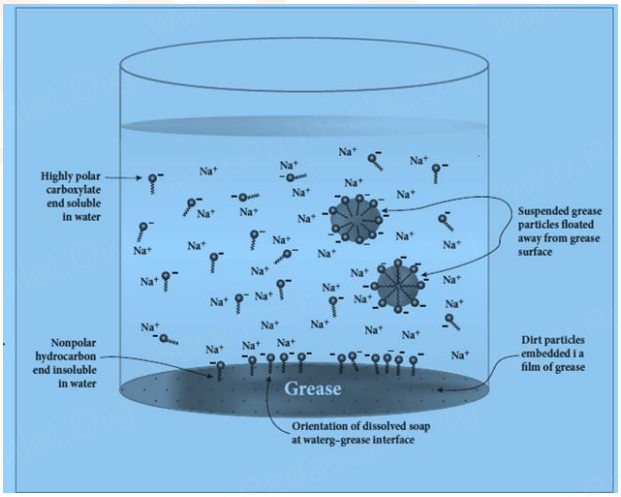
(ii)Tranquilizers acts on the central nervous system by blocking the neurotransitter dopamine in the brain.

(iii)This drug is used for stress anxiety ,depression ,sleep disorders and severe mental disease like schizophrenia.

10. Write the structural formula of aspirin.



11. Explain the mechanism of cleansing action of soaps and detergents



- Consider sodium palmitate an example of a soap.
- The cleansing action of soap is directly related to the structure of carboxylate ions (palmitate ion) present in soap.
- The structure of palmitate exhibit dual polarity.
- The hydrocarbon portion is non polar and the carboxyl portion is polar.
- The hydrophobic hydro carbon portion is soluble in oils and greases, but not in water.
- The hydrophilic carboxylate group is soluble in water.
- The dirt in the cloth is due to the presence of dust particles intact or grease which stick.
- When the soap is added to an oily or greasy part of the cloth, the hydrocarbon part of the soap dissolve in the grease, leaving the negatively charged carboxylate end exposed on the grease surface.
- At the same time the negatively charged carboxylate groups are strongly attracted by water, thus leading to the formation of small droplets called micelles and grease is floated away from the solid object.
- When the water is rinsed away, the grease goes with it.
- As a result, the cloth gets free from dirt and the droplets are washed away with water.
- The micelles do not combine into large drops because their surfaces are all negatively charged and repel each other.

- The cleansing ability of a soap depends upon its tendency to act as a emulsifying agent between water and water insoluble greases.

12. Which sweetening agent are used to prepare sweets for a diabetic patient?
Artifical sweetening agent such as
(i)Saccharin (ii)Alitame (iii)Aspartame.

13. What are narcotic and non – narcotic drugs. Give examples
(i)Narcotic drug is an addictive drug that reduces pain,induces sleep and may alter mood or behaviour.
Example : Morphine and codeine.

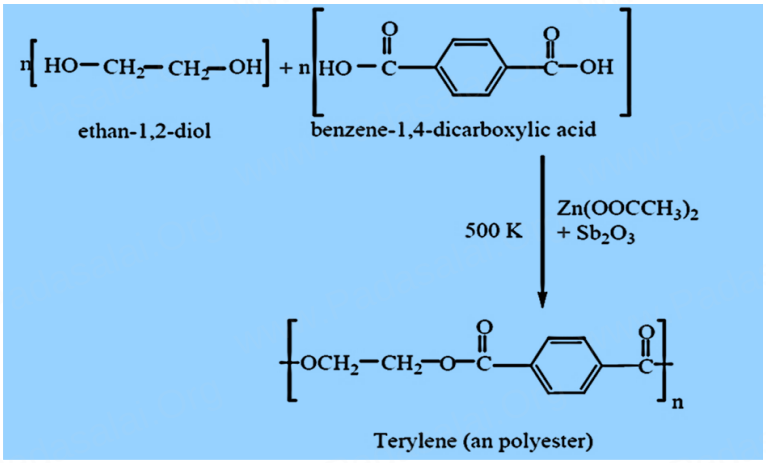
(ii)Non - narcotic drugs are chemical substance(medications) used to control pain and inflammation.They are available at drug stores
Example :Acetaminophen and paracetamol.

14. What are anti fertility drugs? Give examples.
- Artificially drugs are are chemical substances which suppress the action of hormones that promote pregnancy.
- These drugs actually reduces the chance of pregnancy and act as a protection .
- Antifertility are made up of derivatives of progesterone or combination of derivatives of progesterone and oestrogen
- Example: Ethynylestradiol,menstranol,norethynodrel etc.

15. Write a note on co –polymer
- A polymer containing two or more different kinds of monomer units is called a copolymer.
- For example, SBR rubber(Buna-S) contains styrene and butadiene monomer units.
- Co-polymers have properties quite different from the homopolymers.

16. What are bio degradable polymers? Give examples.
(i) The materials that are readily decomposed by microorganisms in the environment are called biodegradable.
(ii) Natural polymers degrade on their own after certain period of time but the synthetic polymers do not .
(iii) It leads to serious environmental pollution. One of the solution to this problem is to produce biodegradable polymers which can be booker down by soil microorganism.
Examples: Polyhydroxy butyrate (PHB)
Polyhydroxy butyrate-co-β- hydroxyl valerate (PHBV)
Polyglycolic acid (PGA), Polylactic acid (PLA)

17. How is terylene prepared?
The monomers are ethylene glycol and terepathalic acid (or) dimethylterephthalate. When trioxide catalyst, terylene is formed.



18. Write a note on vulcanization of rubber

(i)Natural rubber is very soft and brisky.It has high water absorption capacity and low tensile strength.Its properties can improved by a process called vulcanization.

(ii) Natural rubber is mixed with 3-5% sulphur and heated at 100-150˚C causes cross linking of the cis-1,4-polyisoprene chains through disulphide (-S-S-) bonds.

(iii) The physical properties of rubber can be altered by controlling the amount of sulphur that is used for vulcanization. In sulphur rubber, made with about 1 to 3% sulphur is soft and stretchy. When 3 to 10% sulphur is used the resultant rubber is somewhat harder but flexible.

(iv)Following properties of rubber improved by vulcanization.

- Tensile Strength
- Elasticity
- Hardness
- Tear strength
- Resistance to solvents

19. Classify the following as linear, branched or cross linked polymers

a) Bakelite b) Nylon c) polythene

(a) Bakelite-cross linked polymer

(b)Nylon-Linear polymer

(c)Polythene-Linear polymer

20. Differentiate thermoplastic and thermosetting.

Thermoplastic	Thermosetting
They are soften on heating and harden on cooling and they can be remoulded.	They do not soften on heating and they cannot be remoulded.
They consists of linear long chain polymers and low molecular weights polymers.	They consists of three dimensional network structure and high molecular weight polymers.
All the polymer chains are held together by weak Vanderwaal's forces.	All the polymer chains are linked by string covalent bond.
They are weak ,soft and less brittle.	They are strong ,hard and more brittle.
They are formed by additional polymerisation.	They are formed by condensation polymerisation.
They are soluble in organic solvents.	They are insoluble in organic solvents.

Example:PVC,Polythene,Polystrene etc.	Example: Bakelite,Melamine etc.

Knowledge based questions

1. Why should not medicines be taken without consulting doctors?

A medicine can bind to more than one receptor site.
Thus, a medicine may be toxic for some receptor sites.
Further, in most cases, medicines cause harmful effects when taken in higher doses than recommended. As a result, medicines may be poisonous in such cases. Hence, medicines should not be taken without consulting doctors

2. Which forces are involved in holding the drugs to the active site of enzymes?

Either of the following forces can be involved in holding drugs to the active sites of enzymes.
(i) Ionic bonding
(ii) Hydrogen bonding
(iii) Dipole − dipole interaction
(iv) van der Waals force

3. While antacids and antiallergic drugs interfere with the function of histamines, why do these not interfere with the function of each other?

Specific drugs affect particular receptors. Antacids and anti-allergic drugs work on different receptors. This is the reason why antacids and anti-allergic drugs do not interfere with each other's functions, but interfere with the functions of histamines.

4. Low level of noradrenaline is the cause of depression. What types of drugs are needed to cure this problem?

Anti-depressant drugs are needed to counteract the effect of depression.
These drugs inhibit Enzymes catalysing the degradation of the neurotransmitter, noradrenaline.
As a result, the important neurotransmitter is slowly metabolised and then it can activate its receptor for longer periods of time.

5. Why are cimetidine and ranitidine better antacids than sodium hydrogen carbonate or magnesium or aluminium hydroxide?

- Antacids such as sodium hydrogen carbonate, magnesium hydroxide, and aluminium hydroxide work by neutralising the excess hydrochloric acid present in the stomach. However, the root cause for the release of excess acid remains untreated.
- Cimetidine and rantidine are better antacids as they control the root cause of acidity. These drugs prevent the interaction of histamine with the receptors present in the stomach walls. Consequently, there is a decrease in the amount of acid released by the stomach. This is why cimetidine and rantidine are better antacids than sodium hydrogen carbonate, magnesium hydroxide, and aluminium hydroxide

6. Can you use soaps and synthetic detergents to check the hardness of water?

- Soaps get precipitated in hard water, but not in soft water. Therefore, soaps can be used for checking the hardness of water.
- However, synthetic detergents do not get precipitated either in hard water or in soft water. Therefore, synthetic detergents cannot be used for checking the hardness of water

7. If water contains dissolved calcium hydrogen carbonate, out of soaps and synthetic detergents which one will you use for cleaning clothes?

- Synthetic detergents are preferred for cleaning clothes. When soaps are dissolved in water containing calcium ions, these ions form insoluble salts that are of no further use.

- However, when synthetic detergents are dissolved in water containing calcium ions, these ions form soluble salts that act as cleansing agents.

Book inside

Short answers

1.What are antihistamines? Give example and mention its use.

(i)Antihistamines block the histamine release from histamine -1 receptors.
(ii)It is used to provide relief from the allergic effects.
Example: Cetrizine, Terfenadine,l evocetrizine.

2.What are antimicrobials ? Mention its function and its uses.

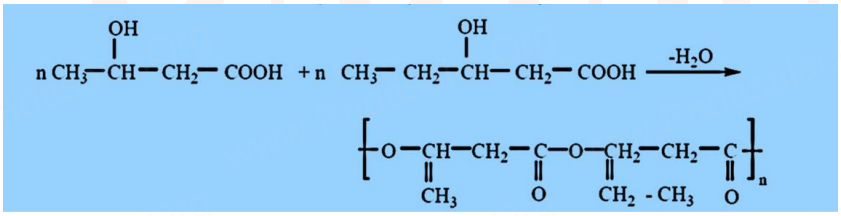
(i)Antimicrobials inhibits bacterial cell wall biosynthesis.
(ii)It is used to treat skin infection,dental infection,ear infection,respiratory tract infection Pneumonia,Urinary infections and gonorrhoea.
Example: Pencillin,Ampicillin.

3.What are sugar substituents? Give example.

The compounds that are used like sugars for sweetening,but are metabolished without the influence of insulin are called sugar substituents.
Example: sorbitol,xylitol,mannitol.

4.How will you prepare PHBV?Give its uses.

(i)It is the co – polymer of the monomers 3 – hydroxybutanoic acid and 3-hydroxypentanoic acid. In PHBV, the monomer units are joined by ester linkages.



Use
It is used in ortho paedic devices, and in controlled release of drugs.

5.What are the difference between elastomers and fibres.Give one example for each.

Elastomers	Fibres
These are rubbers like solids with elastic properties.	These are thread forming solids which possess high tensile strength and high modulus.
These are held by the weak inter molecular forces.	These are held together by strong intermolecular forces like hydrogen bonding.
Example: Buna -S,Buna-N	**Example:** Nylon 6,6 and polysters(terylene)

6.Differentiate between addition and condensation polymers based on the mode of polymerisation.Give one example of each type.

Addition polymers	Condensation polymers
They are formed by adding monomers to growing polymer chain without loss of any molecule.	They are formed by combinig momomers together with the loss of small molecule likeH_2O,NH_3,CO_2.
They are formed from unsaturated compounds.	Momomers have di or poly functional groups.
Example: Polyethene,Polypropene	Example: Nylon-6,6 Nylon-6 Terylene.

7.Distinguish between chain growth polymerisation and step growth polymerisation and give one example each.

Chain growth polymerisation	Step growth polymerisation
Only one repeating unit is added at a time.	Any two species present can react.
Reaction is fast and polymer is formed at once.	Polymer is formed in gradual steps.
Example: Polythene.	**Example:** Nylon-6,6.

8.What are competitive inhibitors?
(i) When a drug molecule that has a similar geometry (shape)as the substrate is administered, it can also bind to the enzyme and inhibit its activity.
(ii) In other words, the drug acts as an inhibitor to the enzyme catalyst. These type of inhibitors are often called competitive inhibitors.

9.What are allosteric inhibitors?
(i) In certain enzymes, the inhibitor molecule binds to a different binding site, which is commonly referred to as allosteric site, and causes a change in its active site geometry (shape).
(ii) As a result, the substrate cannot bind to the enzyme. Th is type of inhibitors are called allosteric inhibitors.

10.Explain the terms (i) Antagonists drugs (ii) Agonist drugs.
(i) Antagonists drugs: The drug that binds to the receptor site should inhibit its natural function. Such drugs are called antagonists.

(ii) Agonist drugs: The drugs which mimic the natural messenger by switching on the receptor. These type of drugs are called agonists and are used when there is lack of chemical messenger.

11.How are anaesthetics classified?
Anaesthetics are broadly classified into
(i)Local anaesthetics.
(ii)General anaesthetics.

12.What are local anaesthetics?Give its uses.
It causes loss of sensation ,in the area in which it is applied without losing consciousness. They block pain perception that is transmitted via peripheral nerve fibres to the brain.
Uses: They are often ued during minor surgical procedures.

13.What are antacids?Give three example of antacid.
It neutralize the acid in the stomach that causes acidity.
Uses: To relieve symptoms such as burning sensation in the chest/ throat area (heart burns) caused by acid reflux.
Example: Milk of Magnesia,Sodium bicarbonate,calcium bicarbonate,aluminium hydroxide

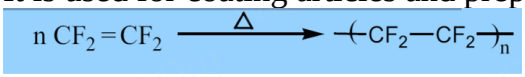
14.Define TFM.
TFM is defined as the total amount of fatty matter that can be separated from sample after splitting with mineral acids.

15.Give the classification of polymers on the basis of their source.
(i)Natural polymers (obtained from plants/animals) e.g Cellulose,Silk.
(ii)Synthetic polymers (man made from chemicals) e.g polythene ,PVC,etc.
(iii)Semisynthetic polymers(natural polymers modified by chemical treatment) e.g viscose rayon,cellulose diacetate.

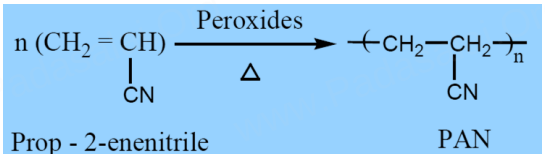
16.What do you mean by chain growth mechanism.
The chain growth mechanism involves the addition of the reactive end of the growing chain across the double bond of the monomer.

17.What are mechanisms by which addition polymerisation occurs?
The addition polymerisation can follow any of the following three mechanisms depending upon the reactive intermediate involved in the process
i. Free radical polymerisation
ii. Cationic polymerisation
iii. Anionic polymerisation

18.Write the preparation of Teflon and give its uses.
The monomer is tetrafluroethylene. When the monomer is heated with oxygen (or) ammonium persulphate under high pressure, Teflon is obtained.
It is used for coating articles and preparing non – stick utensils.



19.Write note on Orlon.
It is poly acrylonitrile
It is prepared by the addition polymerisation of vinylcyanide (acrylonitrile) using a peroxide initiator.
It is used as a substitute of wool for making blankets, sweaters etc.



20.Why are Ranitidine and Cemitidine antacids better than sodium bicarbonate.
Sodium bicarbonate makes the stomach alkaline and thus more HCL is released which causes ulcer. Whereas Ranitidine prevent the interaction of histamine in the stomach wall and thus reduces the amount of HCL release.

21.What are the physical methods to preserve food?
i)Heat treatment (pasteurisation and sterilisations)
ii)Cold treatment (chilling and freezing) iii)drying (dehydration)

22.What is preservatives ? Write down its example

- Preservatives are capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food by growth of microorganisms.
- Organic acids such as benzoic acid, sorbic acid and their salts are potent inhibitors of a number of fungi, yeast and bacteria

Example Acetic acid is used mainly as a preservative for the preparation of pickles and for preserved vegetables

23.Write a note on antioxidants

- Antioxidants are substances which retard the oxidative deteriorations of food. Food containing fats and oils is easily oxidised and turn rancid.
- To prevent the oxidation of the fats and oils, chemical BHT(butylhydroxy toluene), BHA(Butylated hydroxy anisole) are added as food additives.
- They are generally called antioxidants.
- These materials readily undergo oxidation by reacting with free radicals generated by the oxidation of oils, thereby stop thechain reaction of oxidation of food. Sulphur dioxide and sulphites are also used as food additives.
- They act as anti-microbial agents, antioxidants and enzyme inhibitors.

3marks

1.Name some important categories of food additives.

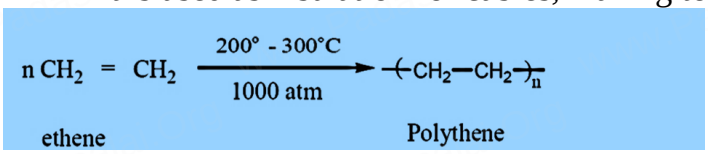
• Aroma compounds
• Food colours
• Preservatives
• Stabilizers
• Artificial Sweeteners
• Antioxidants
• Buffering substances
• Vitamins and minerals

2.Give some of the advantages of using food additives.

(i) Uses of preservatives reduce the product spoilage and extend the shelf-life of food
(ii) Addition of vitamins and minerals reduces the mall nutrient
(iii) Flavouring agents enhance the aroma of the food
(iv) Antioxidants prevent the formation of potentially toxic oxidation products of lipids and other food constituents.

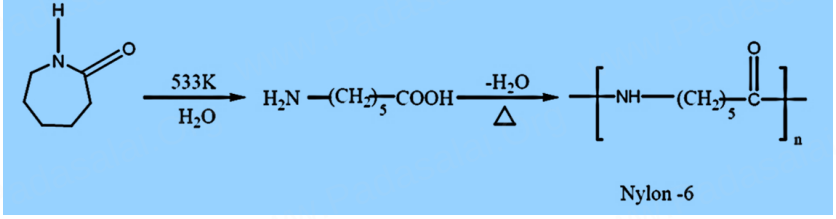
3.How is low density polythene prepared?

- It is formed by heating ethene at 200 to 300 ° C under oxygen as a catalyst.
- The reactionfollows free radical mechanism.
- The peroxides formed from oxygen acts as a free radical initiator.
- It is used as insulation for cables, making toys etc..



4.The monomer is capro lactam .Identify the polymer when the monomer is heated at 533K.

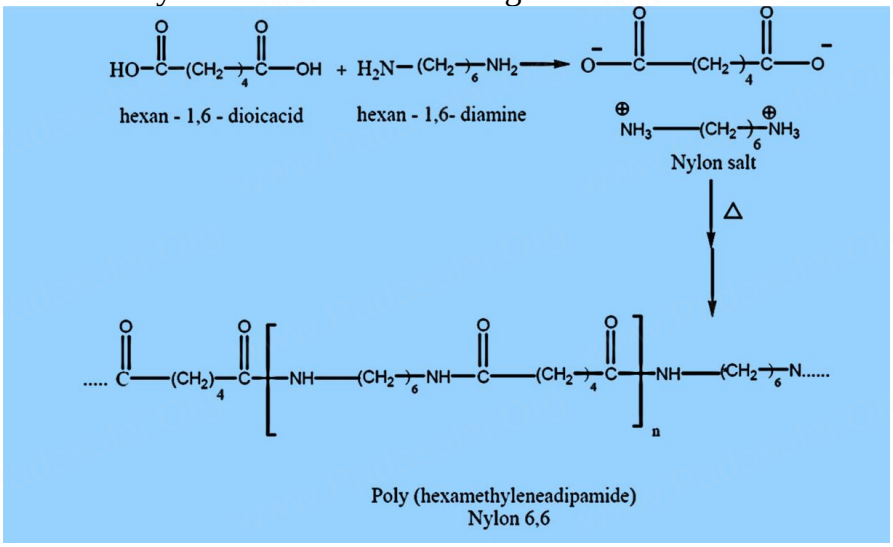
Capro lactam (monomer) on heating at 533K in an inert atmosphere with traces of water gives ∈ α amino carproic acid which polymerises to give nylon – 6.



5.How is Nylon -6,6 prepared?Give its use.

Nylon – 6,6

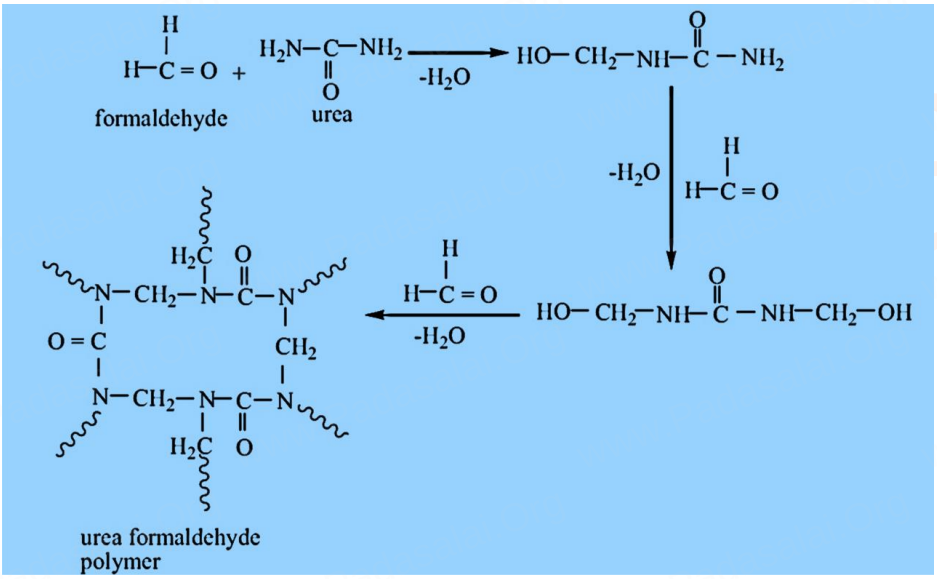
Nylon – 6,6 can be prepared by mixing equimolar adipic acid and hexamethylene – diamine to form a nylon salt which on heating eliminate a water molecule to form amide bonds.



Uses

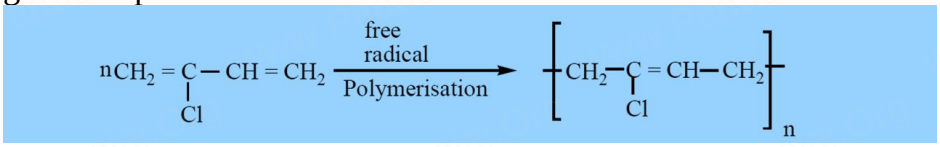
It is used in textiles, manufacture of cards etc.

6.Give the condensation reaction between urea and formaldehyde.Identify the polymer.



7.Write the preparation of neoprene and give its use.

The free radical polymeristion of the monomer, 2-chloro buta-1,3-diene(chloroprene) gives neoprene.

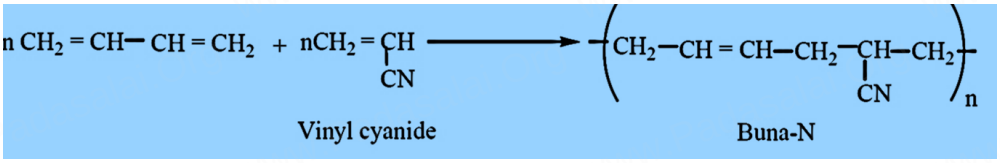


Use

It is used in the manufacture of chemical containers, conveyer belts.

8.How is Buna-N prepared?Give its use.

It is a co-polymer of acrylonitrile and buta-1,3-diene.

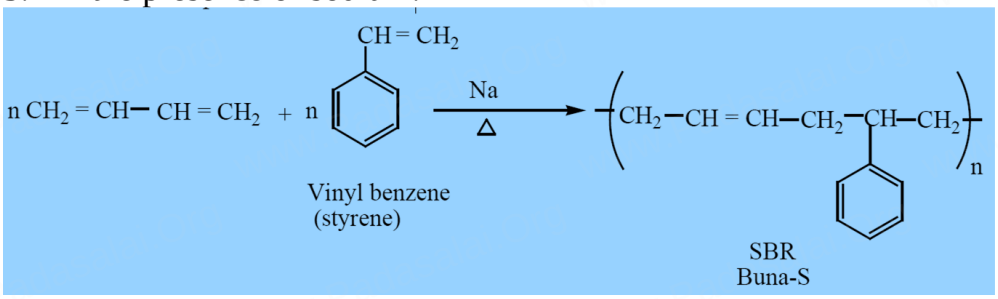


Use

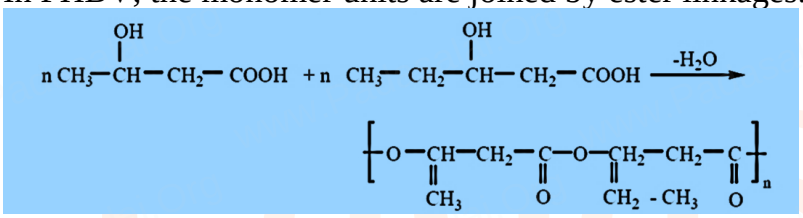
It is used in the manufacture of hoses and tanklinings.

9.Identify the polymer and write the reaction involved
(i)Buta-1,3 -diene and styrene in the presence of sodium
(ii)3-hydroxy butanoic acid and 3-hydroxy pentanoic acid.

(i)It is a co-polymer. It is obtained by the polymerisation of buta-1,3-diene and styrene in the ratio 3:1 in the presence of sodium.



(ii)It is the co – polymer of the monomers 3 – hydroxybutanoic acid and 3-hydroxypentanoic acid. In PHBV, the monomer units are joined by ester linkages.



10.Differentiate soap and detergents.

Soap	Detergents
Soap are sodium or potassium salt of long chain fatty acids.	Detergent is sodium salt of alkyl hydrogen sulphate or alkyl benzene sulphonic acid.
Soaps are made from animal or plant fats and oils.	Detergents are made from petrochemicals.
Soaps have lesser cleansing action.	Detergents have more cleansing action.
Soaps are bio -degradable	Detergents are non bio-degradable.
Soaps are less effective in hard water.	Detergents are more effective in hard water.
They have tendency to form scum in hard water.	They do not form sum with hard water.
Example: Sodium palmitate.	Example: Sodium lauryl sulphate.

11.Write note on drug target interaction.

(i) The biochemical processes such as metabolism (which is responsible for breaking down the food molecules and harvest energy in the form of ATP and biosynthesis of necessary biomolecules from the available precursor molecules using many enzymes),cell-signaling (senses any change in the environment using the receptor molecules and send signals to various processes to elicit an appropriate response) etc… are essential for the normal functioning of our body.

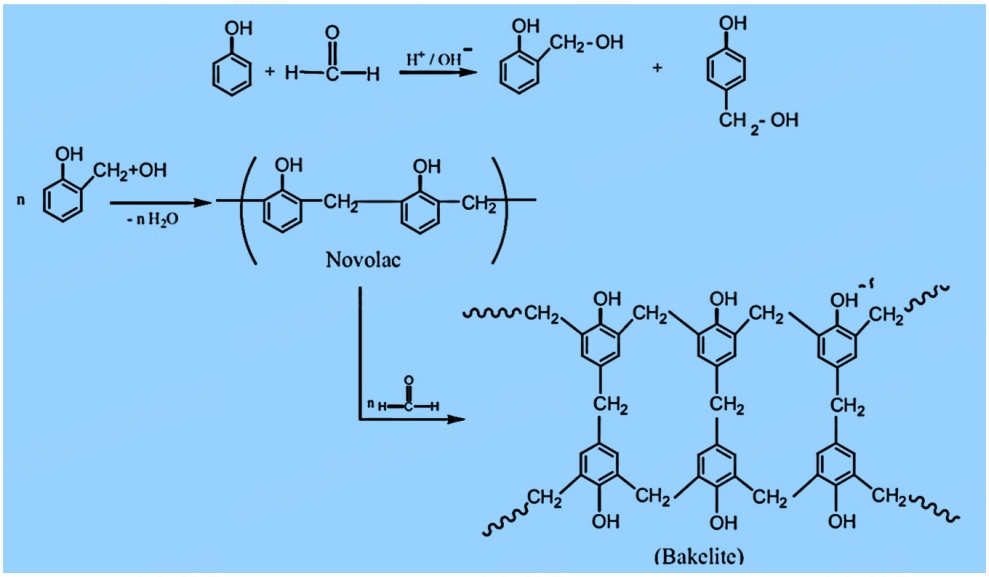
(ii) These routine processes may be disturbed by any external factors such as microorganism, chemicals etc.. or by a disorder in the system itself.

(iii)Under such conditions we may have to take medicines to restore the normal functioning of the body.
(iv) These drug molecules interact with biomolecules such as proteins, lipids that are responsible for different functions of the body. For example, proteins which act as biological catalysts are called enzymes and those which are important for communication systems are called receptors.
(v) The drug interacts with these molecules and modify the normal biochemical reactions either by modifying the enzyme activity or by stimulating/suppressing certain receptors.

12.Explain Receptor as a drug targets.
(i) Many drugs exert their physiological effects by binding to a specific molecule called a receptor whose role is to trigger a response in a cell.
(ii)Most of the receptors are integrated with the cell membranes in such a way that their active site is exposed to outside region of the cell membrane.
(iii) The chemical messengers, the compounds that carry messages to cells, bind to the active site of these receptors.
(iv) This brings about the transfer of message into the cell. These receptors show high selectivity for one chemical messenger over the others.
(v) If we want to block a message, a drug that binds to the receptor site should inhibit its natural function. Such drugs are called antagonists.
(vi) In contrast, there are drugs which mimic the natural messenger by switching on the receptor. These type of drugs are called agonists and are used when there is lack of chemical messenger.
(vii) For example, when adenosine binds to the adenosine receptors, it induces sleepiness. On the other hand, the antagonist drug caffeine binds to the adenosine receptor and makes it Inactive.
(viii) This results in the reduced sleepiness (wakefulness).The agonist drug, morphine, which is used as a pain killer, binds to the opioid receptorsand activates them. This supress the neuro transmitters that causes pain.

13.Explain the preparation of bakelite and give its use.

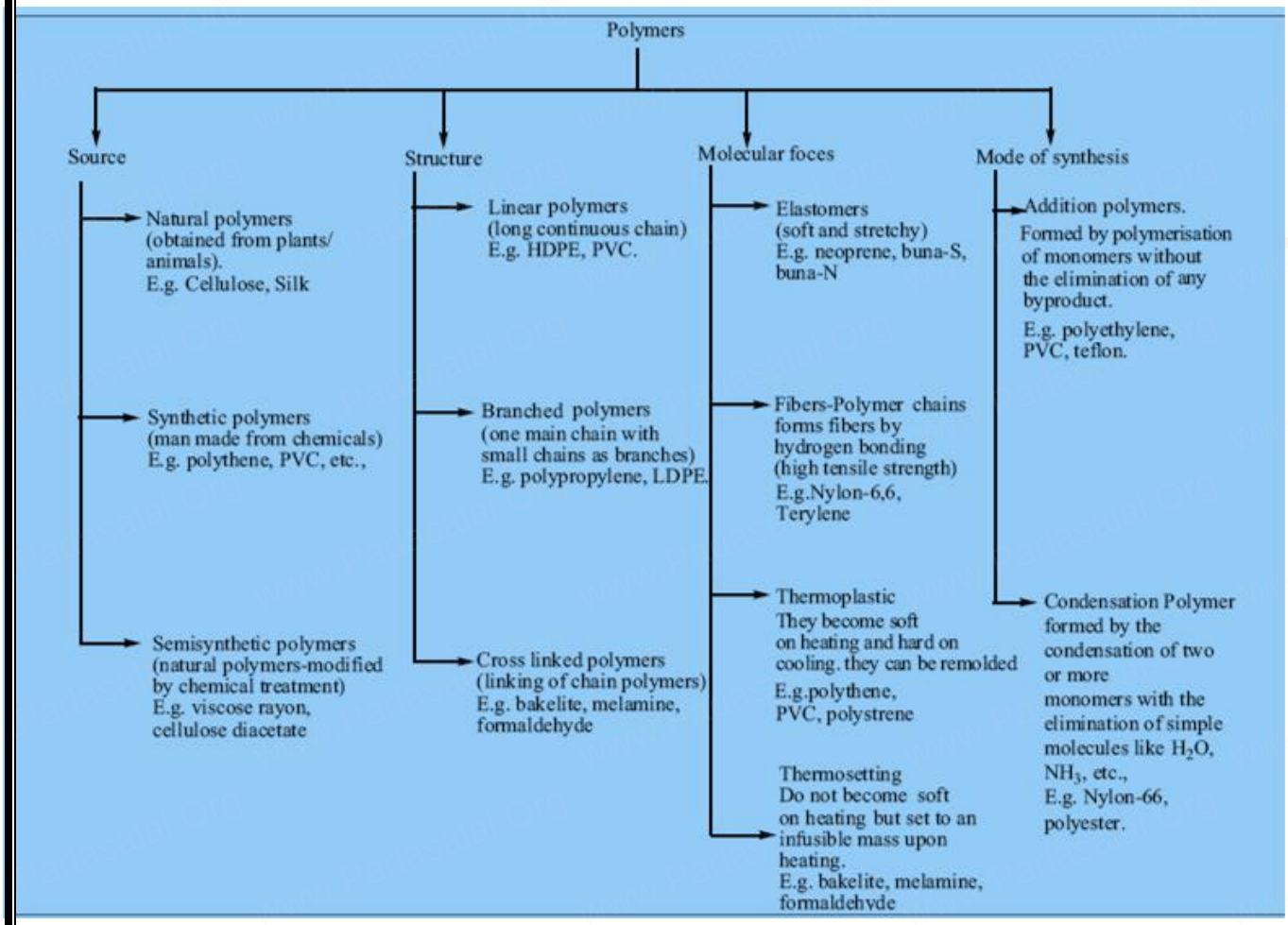
- The monomers are phenol and formaldehyde. The polymer is obtained by the condensation polymerization of these monomers in presence of either an acid or a base catalyst.
- Phenol reacts with methanal to form ortho or para hydroxyl methylphenols which on
- further reaction with phenol gives linear polymer called novolac. Novalac on further heating with formaldehyde undergo cross linkages to form backelite.



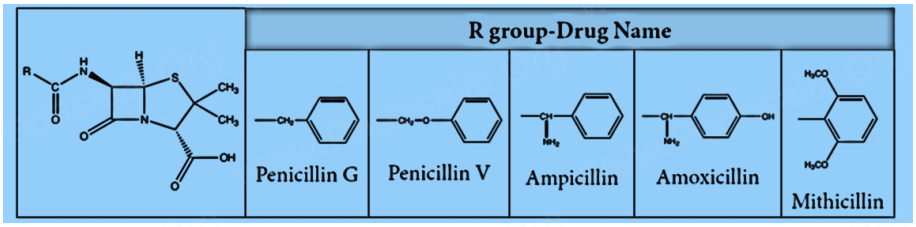
Use

Navolac is used in paints. Soft backelites are used for making glue for binding laminated wooden planks and in varinishes, Hard backelites are used to prepare combs, pens etc..

14.Classification of polymer



15.Draw the structure of penicillin



16.Explain about competitive inhibition with example or How growth of bacteria is prevented by competitive inhibition ?

- When a drug molecule that has a similar geometry (shape)as the substrate is administered, it can also bind to the enzyme and inhibit its activity.In other words, the drug acts as an inhibitor to the enzyme catalyst.
- These type of inhibitors are often called competitive inhibitors.
- For example the antibiotic sulphanilamide, which is structurally similar to *p*-aminobenzoic acid (PABA) inhibits the bacterial growth.
- Many bacteria need PABA in order to produce an important coenzyme, folic acid. When the antibiotic sulphanilamide is administered, it acts as a competitive inhibitor to the enzyme dihydropteroate synthase (DHPS) in the biosynthetic pathway of converting PABA into folic acid in the bacteria.
- It leads to the folic acid deficiency which retards the growth of the bacteria and can eventually kill them.

17.Explain the use of antagonist drug caffeine agonist drug, morphine

- When adenosine binds to the adenosine receptors, it induces sleepiness. On
- the other hand, the antagonist drug caffeine binds to the adenosine receptor and makes it inactive. This results in the reduced sleepiness (wakefulness).
- The agonist drug, morphine, which is used as a pain killer, binds to the opioid receptors and activates them. This supress the neuro transmitters that causes pain.

18.Explain about mode of action and use of Tranquilizers

Tranquilizers

They are neurologically active drugs.

Major tranquilizers: Haloperidol, clozapine

Minor tranquilizers: Diazepam (Valium), alprazolam

Mode of action

Acts on the central nervous system by blocking the neurotransmitter dopamine in the brain

Use

Treatment of stress, anxiety, depression, sleep disorders and severe mental diseases like schizophrenia

19.Explain about mode of action and use of Analgesics

Analgesics reduce the pain without causing impairment of consciousness.

Mode of action

They alleviate pain by reducing local inflammatory responses

Use

Antiinflammatory drugs

Used for short-term pain relief and for modest painlike headache, muscle strain, bruising, or arthritis.

Example - Acetaminophen or paracetamol,

Antipyretics
These drugs have many other effects such as reducing fever (antipyretic) and preventing platelet coagulation.
Due to this property, aspirin finds useful in the prevention of heart attacks
Example _ Acetylsalicylic acid (aspirin),
Nonsteroidal anti-inflammatory drugs (NSAIDs)
Reduces fever by causing the hypothalamus to override a prostaglandin-induced increase in temperature.
Example – Ibuprofen

20.Explain about use of Opioids (Narcotic Analgesics)
Use
- Relive pain and produce sleep. These drugs are addictive.
- Used for either short term or long-term relief of severe pain.
- Mainly used for post operative pain, pain of terminalcancer.

21.Explain about General anaesthetics
Cause a controlled and reversible loss of consciousness by affecting central nervous system

Uses
They are often used for major surgical procedures
Example
Intravenous general anaesthetics – Propofol
Inhalational general anaesthetics - Isoflurane

22.Explain about Macrolides , Fluoroquinolones , Tetracyclines

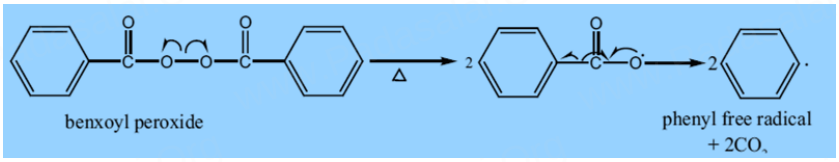
	Macrolides	**Fluoroquinolones**	**Tetracyclines**	**Aminoglycosides**
Property	Targets bacterial ribosomes and prevent protein production	Inhibits bacterial enzyme DNA gyrase	Inhibit the bacterial protein synthesis via interaction with the 30S subunit of the bacterial ribosome	Bind to the 30S subunit of the bacterial ribosome, thus stopping bacteria from making proteins
Use	To treat respiratory tract infections, genital, gastrointestinal tract and skin infections	To treat urinary tract infections, skin infections, and respiratory infections (such as sinusitis, pneumonia, bronchitis), pulmonary infections in cystic fibrosis	Used in the treatment of peptic ulcer disease, infections of the respiratory tract, cholera, acne vulgaris	Used to treat infections caused by gram-negative bacteria
Example	Erythromycin, azithromycin	Clinafloxacin, ciprofloxacin, levofloxacin	Doxycycline, minocycline, oxytetracycline	Kanamycin, gentamicin, neomycin

23.Explain how Free radical polymerisation occurs ?

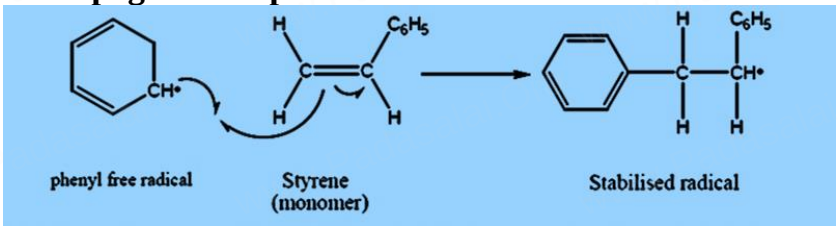
- When alkenes are heated with free radical initiator such as benzyl peroxide, they undergo polymerisation reaction.
- For example styrene polymerises to polystyrene when it is heated to ionic with a peroxide initiator.

The mechanism involves the following steps.

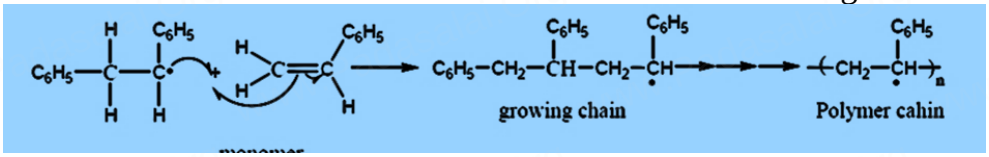
1. Initiation – formation of free radical



2. Propagation step



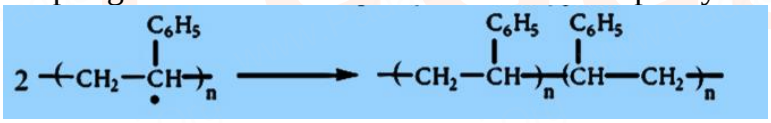
The stabilized radical attacks another monomer molecule to give an elongated radical



Chain growth will continue with the successive addition of several thousands of monomer units.

Termination

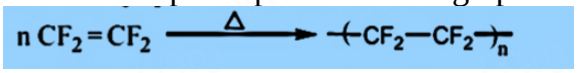
The above chain reaction can be stopped by stopping the supply of monomer or by coupling of two chains or reaction with an impurity such as oxygen.



24.How will you prepare i) Teflon ii) Melamine (Formaldehyde melamine) iii) PHBV iv) Nylon– 2-Nylon -6

Teflon

The monomer is tetrafluroethylene. When the monomer is heated with oxygen (or) ammonium persulphate under high pressure, Teflon is obtained.

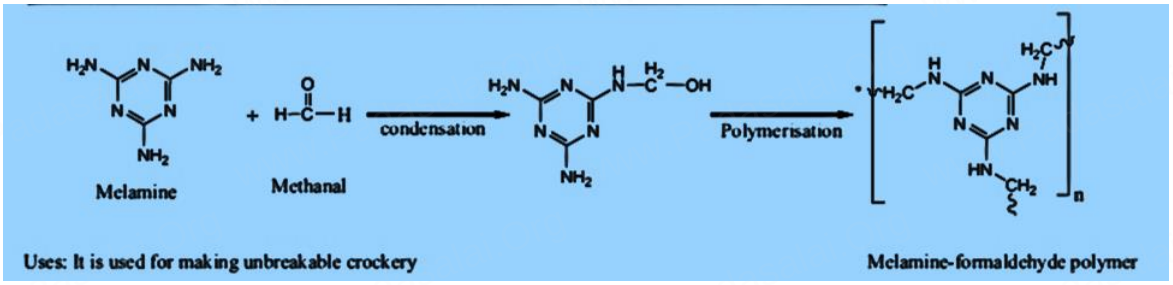


Use

It is used for coating articles and preparing non – stick utensils

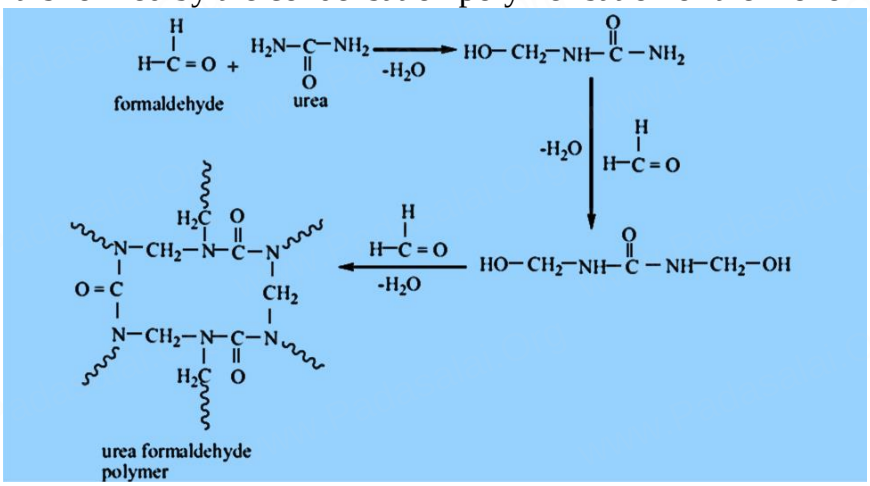
Melamine (Formaldehyde melamine)

The monomers are melamine and formaldehyde. These monomers undergo condensation polymerisation to form melamine formaldehyde resin.



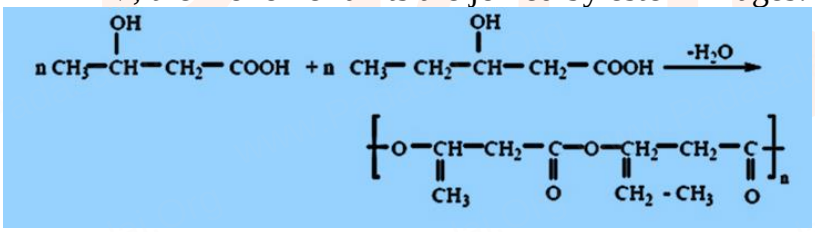
Urea formaldehyde polymer

It is formed by the condensation polymerisation of the monomers urea and formaldehyde.



PHBV

It is the co – polymer of the monomers 3 – hydroxybutanoic acid and 3 hydroxypentanoic acid. In PHBV, the monomer units are joined by ester linkages.



Uses : It is used in ortho paedic devices, and in controlled release of drugs.

Nylon– 2-Nylon -6

It is a co – polymer which contains polyamide linkages. It is obtained by the condensation polymersiation of the monomers, glycine and É - amino caproic acid.