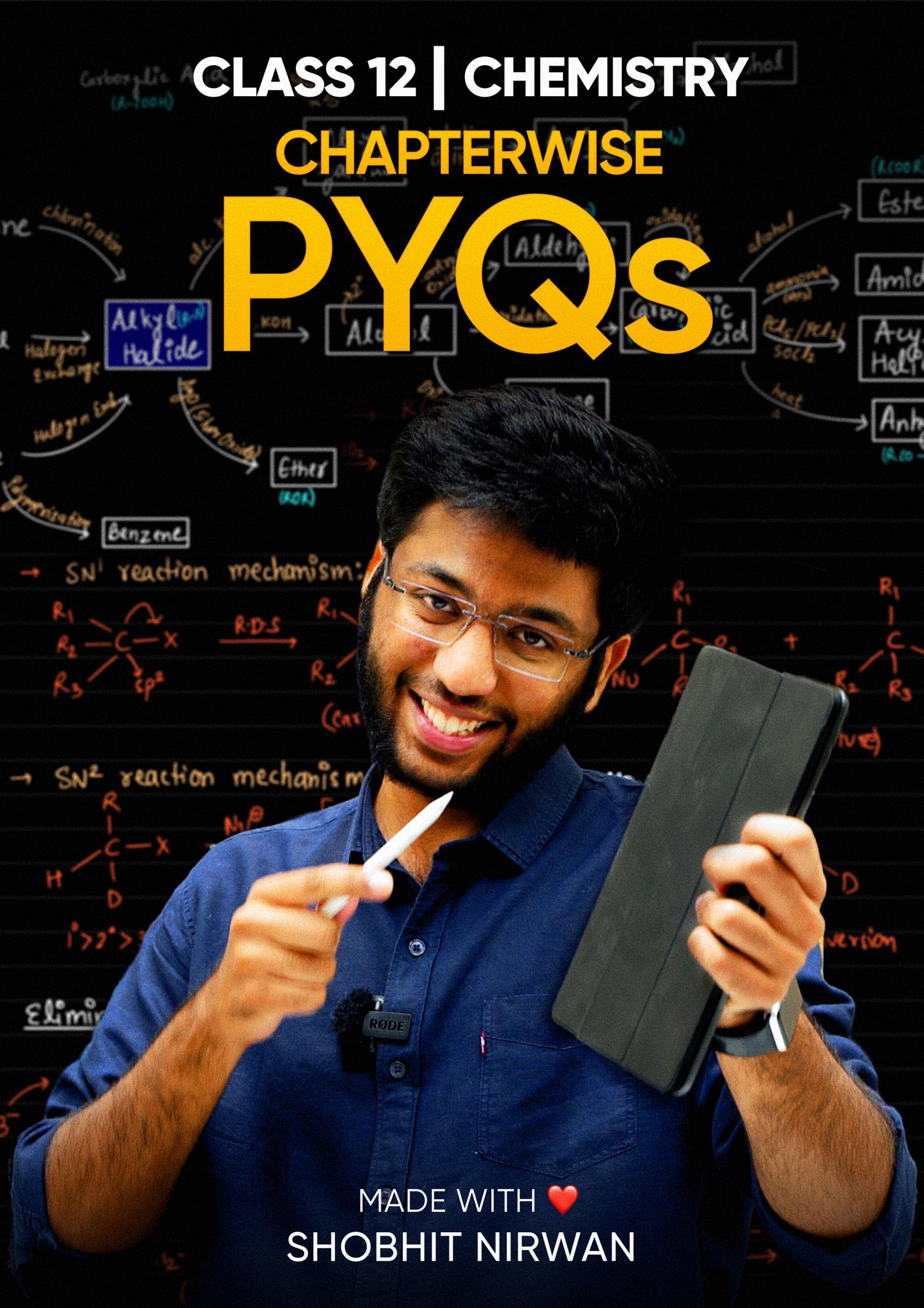


CLASS 12 | CHEMISTRY

CHAPTERWISE

PYQs

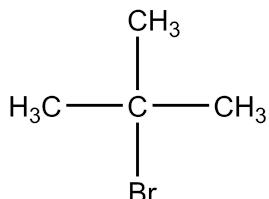


MADE WITH ❤️
SHOBHIT NIRWAN

HALOALKANES AND HALOARENES

2016

1) Write the structure of an isomer of compound C_4H_9Br which is most reactive towards SN1 reaction.

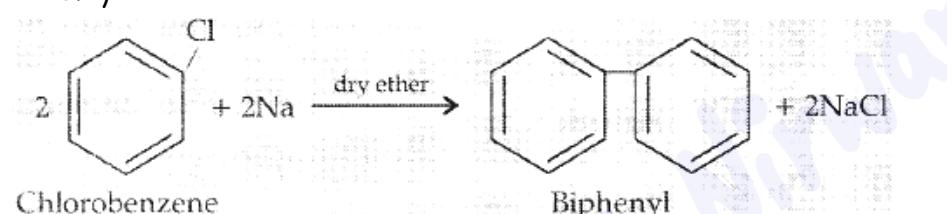


Ans. tert butyl bromide

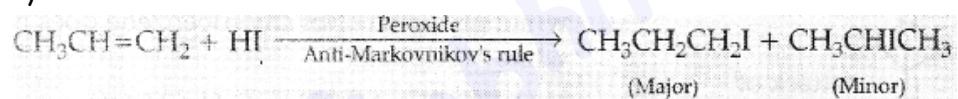
2) How do you convert:

- i) Chlorobenzene to biphenyl
- ii) Propene to 1-iodopropane
- iii) 2-bromobutane to but-2-ene

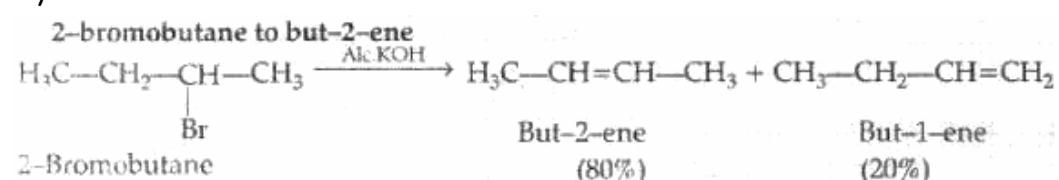
Ans. i)



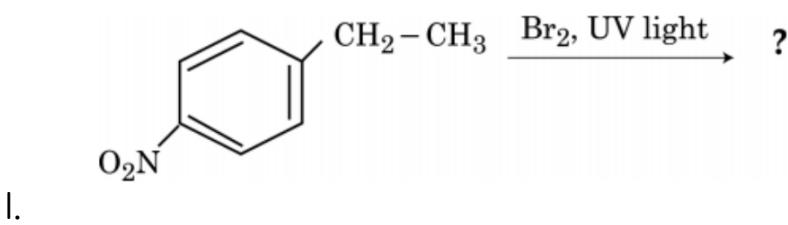
ii)

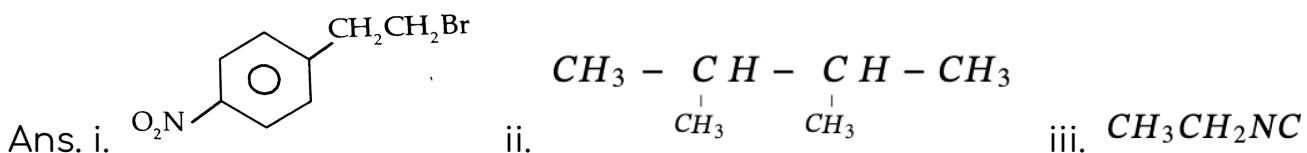
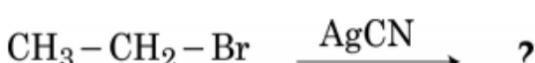
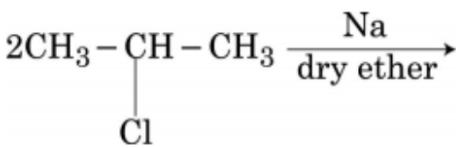


iii)



3) Write the major Product(s) in the following:





2017

1) The following compounds are given to you :

2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane

(a) Write the compound which is most reactive towards $\text{S}_{\text{N}}2$ reaction.

(b) Write the compound which is optically active.

(c) Write the compound which is most reactive towards β -elimination reaction

Ans. (a) 1- Bromopentane is most reactive towards $\text{SN}2$ reaction.

(b) 2-Bromo-2-methylbutane

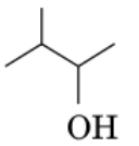
(c) 2- Bromopentane is most reactive towards β -elimination reaction with product of pent-1-ene pent-2-ene.

2018

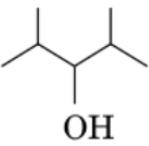
1) Out of chlorobenzene and benzyl chloride, which one gets easily hydrolysed by aqueous NaOH and why?

Ans. Benzyl chloride

2) a) Identify the chiral molecule in the following pair:



&



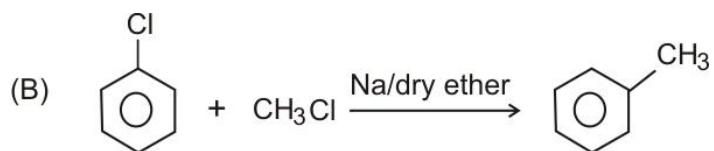
(i)

(ii)

b) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether

c) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1 methylcyclohexane with alcoholic KOH .

Ans. (A) (i)



2019

1) Out of Chlorobenzene and Cyclohexyl chloride, which one is more reactive towards nucleophilic substitution reaction and why?

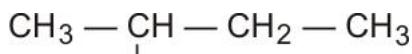
Ans. Cyclohexyl chloride

2) Among all the isomers of molecular formula C₄HBr, identify

(a) the one isomer which is optically active.

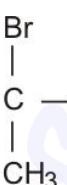
(b) the one isomer which is highly reactive towards S_N2.

(c) the two isomers which give same product on dehydrohalogenation with alcoholic KOH.



Ans. a)

b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$

(C) (i)  2-Bromo-2-methylpropane

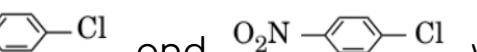
(ii)  1 - bromo-2-methylpropane

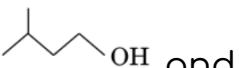
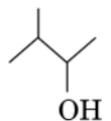
3) Why is chloroform kept in dark coloured bottles ?

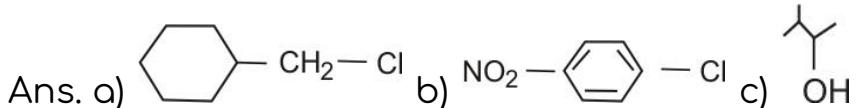
Ans. to avoid the formation of phosgene

4)

(a) Out of  , which one is more reactive towards S_N2 reaction and why ?

(b) Out of  which one is more reactive towards nucleophilic substitution reaction and why ?

(c) Out of  and  which one is optically active and why ?

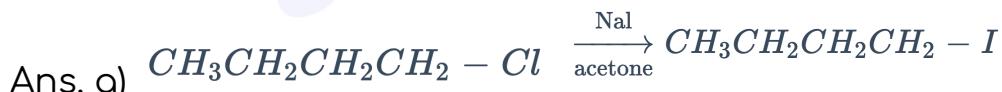
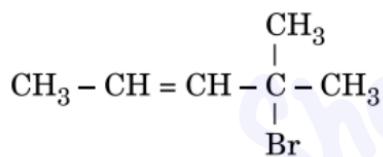


5) Why is t-butyl bromide more reactive towards SN1 reaction as compared to n-butyl bromide ?

6) Give reasons for the following :

- (a) The presence of -NO₂ group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution reactions.
- (b) *p*-dichlorobenzene has higher melting point than that of ortho or meta isomer.
- (c) Thionyl chloride method is preferred for preparing alkyl chloride from alcohols.

7) (a) Write equation for preparation of 1-iodobutane from 1-chlorobutane.
 (b) Out of 2-bromopentane, 2-bromo-2-methylbutane and 1-bromopentane, which compound is most reactive towards elimination reaction and why?
 (c) Give IUPAC name of



- b) 2-bromopentane
- c) 4-bromo-4-Methylpent-2-ene

8) (a) Define the following terms:

- (i) Enantiomers
- (ii) Racemic mixture
- (b) Why is chlorobenzene resistant to nucleophilic substitution reaction?

2022

1) Read the given passage and answer the questions number 1 to 5 that follow: 1×5=5

The substitution reaction of alkyl halide mainly occurs by SN1 or SN2 mechanism. Whatever mechanism alkyl halides follow for the substitution reaction to occur, the polarity of the carbon halogen bond is responsible for these substitution reactions. The rate of SN1 reactions are governed by the stability of carbocation whereas for SN2 reactions steric factor is the deciding factor. If the starting material is a chiral compound, we may end up with an inverted product or racemic mixture depending upon the type of mechanism followed by alkyl halide. Cleavage of ethers with HI is also governed by steric factor and stability of carbocation, which indicates that in organic chemistry, these two major factors help us in deciding the kind of product formed.

1. Predict the stereochemistry of the product formed if an optically active alkyl halide undergoes substitution reaction by SN1 mechanism.
2. Name the instrument used for measuring the angle by which the plane polarised light is rotated.
3. Predict the major product formed when 2-Bromopentane reacts with alcoholic KOH.
4. Give one use of CHI₃.
5. Write the structures of the products formed when anisole is treated with HI.

Ans. 1. Racemic Mixture 2. Polarimeter 3. Pent-2-ene 5. Phenol +CH-I₃

2) Assertion (A): Boiling points of alkyl halides decrease in the order R-I > R-Br > R-Cl > R-F.

Reason (R): Van der Waals forces decrease with increase in the size of halogen atom.

Ans. Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A).

3) Justify and arrange the following

- (a) 1-Bromobutane, 2-Bromobutane, 2-Bromo-2-Methylpropane (SN1 reaction)
- (b) 1-Bromobutane, 2-Bromobutane, 2-Bromo-2-Methylpropane (SN2 reaction)

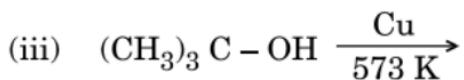
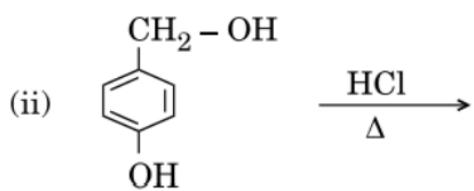
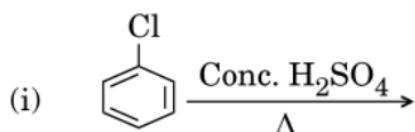
Ans. a) 1-bromobutane < 2-bromobutane < 2-bromo-2-methylpropane.
b) 2-bromo-2-methyl propane < 2-bromobutane < 1-bromobutane

4) Racemisation occurs in

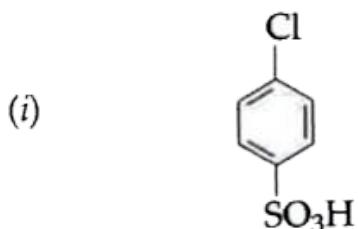
- (A) S_N2 reaction
- (B) S_N1 reaction
- (C) Neither S_N2 nor S_N1 reactions
- (D) S_N2 reaction as well as S_N1 reaction

Ans. (B)

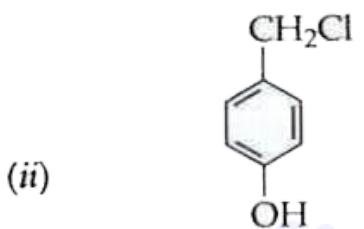
5) Write the major products of the following reactions :



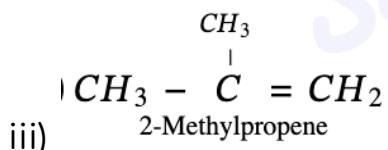
Ans.

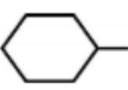
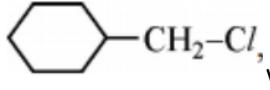


4-Chlorobenzenesulphonic acid



4-Hydroxybenzyl chloride



6) Out of  and , which one is more reactive towards $\text{S}_{\text{N}}1$ reaction?



Ans. chlorocyclohexane

7) Assertion (A) : $(\text{CH}_3)_3\text{C}-\text{O}-\text{CH}_3$ gives $(\text{CH}_3)_3\text{C}-\text{I}$ and CH_3OH on treatment with HI .

Reason (R): The reaction occurs by S_N1 mechanism.

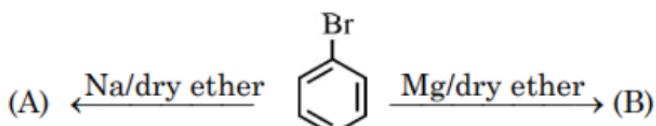
Ans. both Assertion and Reason are false.

8) (i) Write the structure of major alkene formed by B-elimination of 2, 2, 3-trimethyl-3-bromo with sodium ethoxide in ethanol.

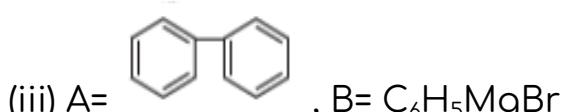
(ii) Which one of the compounds in the following pairs is chiral?



(iii) Identify (A) and (B) in the following:

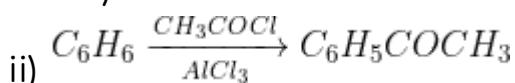
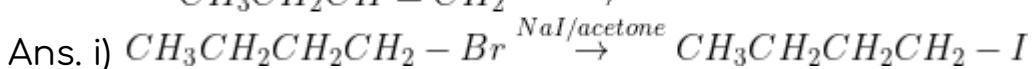
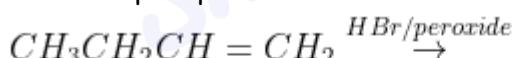


Ans. (i) (CH₃)₃C-C(CH₃)=CHCH₃



9) How can you convert the following?

- (i) But-1-ene to 1-iodobutane
- (ii) Benzene to acetophenone
- (iii) Ethanol to propanenitrile.

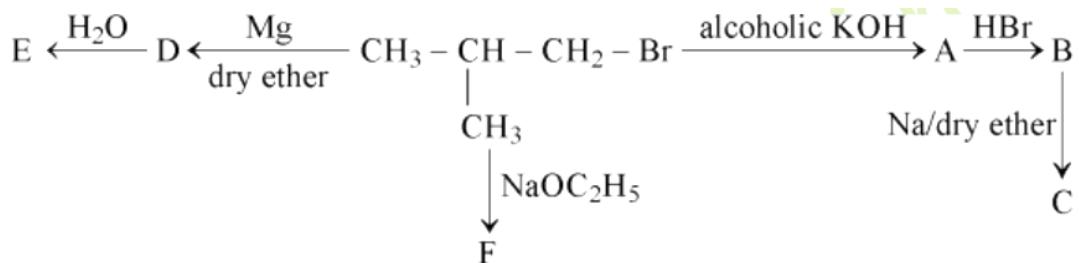


10) The conversion of an alkyl halide into an alcohol by aqueous NaOH is classified as

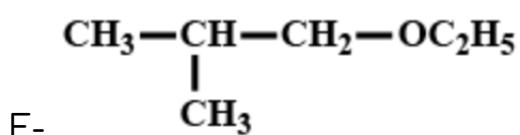
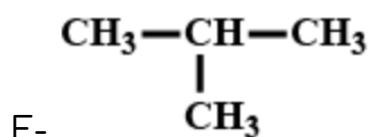
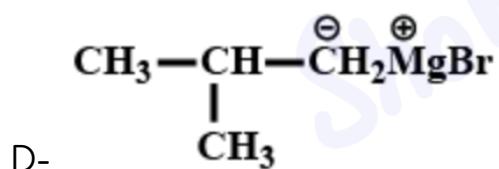
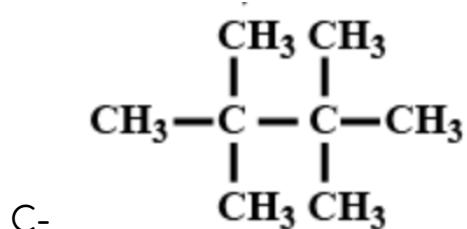
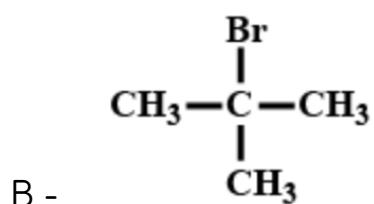
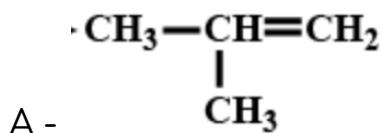
- (a) a dehydrohalogenation reaction
- (b) a substitution reaction
- (c) an addition reaction
- (d) a dehydration reaction

Ans. (B)

11) Identify A, B, C, D, E and F in the following :



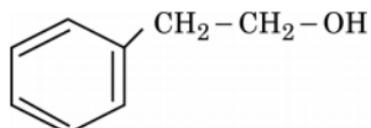
Ans.



ALCOHOLS, PHENOLS AND ETHERS

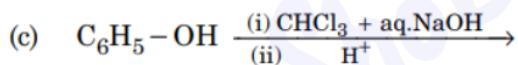
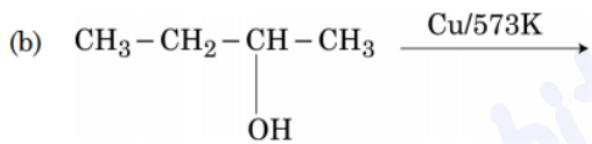
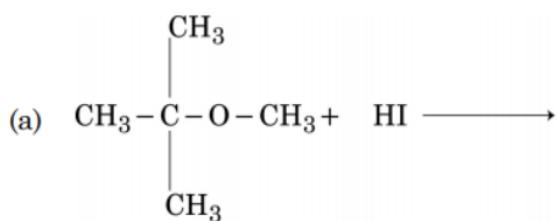
2016

1) Write the IUPAC name of the following molecule

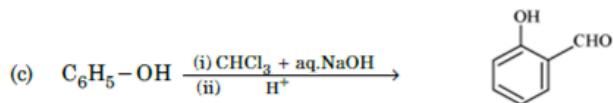
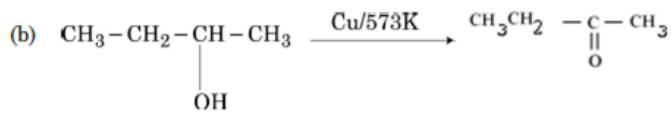
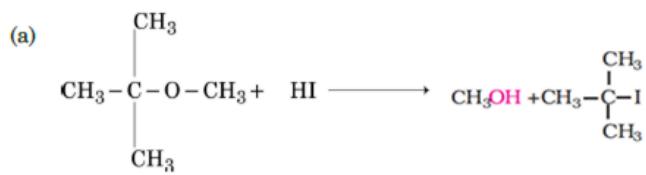


Ans. 1-phenyl ethan-2-ol

2) Write the final products in the following equations

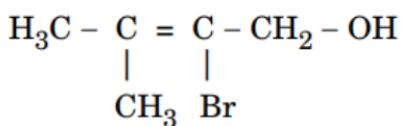


Ans.



2017

1) Write the IUPAC name of the following compound :



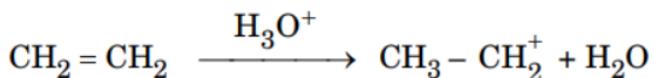
Ans. 2-Bromo 3-Methyl but-2-en-1-ol

2)

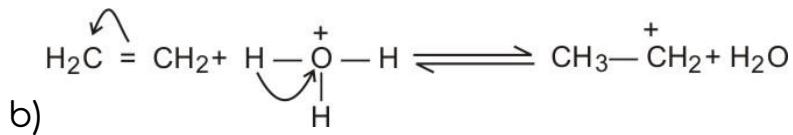
a) Arrange the following compounds in the increasing order of their acid strength :

p-cresol, p-nitrophenol, phenol

b) Write the mechanism (using curved arrow notation) of the following reaction :



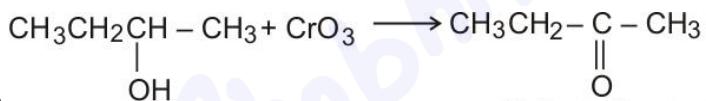
Ans. a) p-cresol < phenol < p- nitrophenol



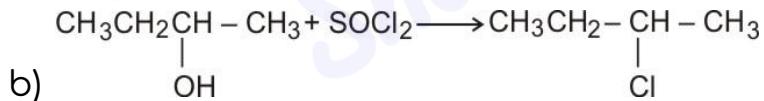
3) Write the structures of the products when Butan-2-ol reacts with the following :

a) CrO_3

b) SOCl_2

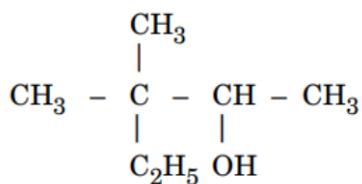


Ans. a) Butan - 2 - one



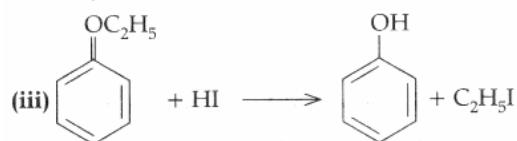
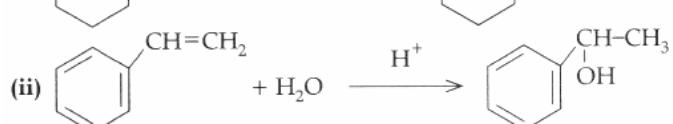
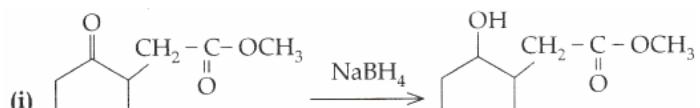
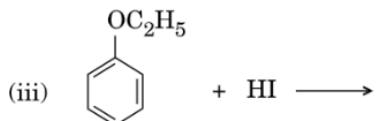
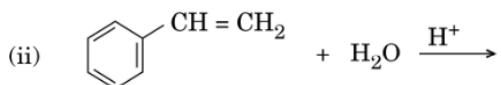
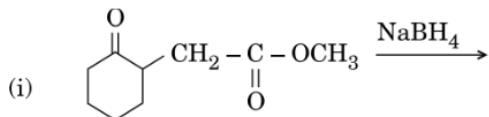
2018

1) Write the IUPAC name of the following:



Ans. 3-Methylpentan-2-ol

2) Write the structures of the main products in the following reactions :



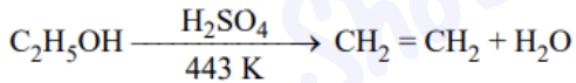
Ans.

2019

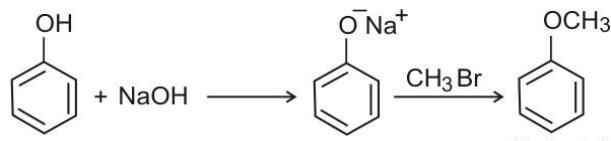
1) (a) How do you convert the following:

- (i) Phenol to Anisole
- (ii) Ethanol to Propan-2-ol

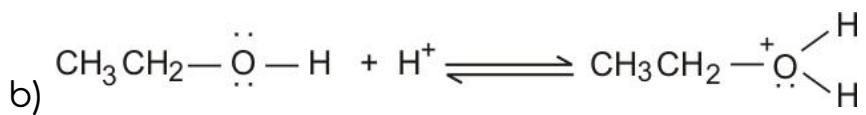
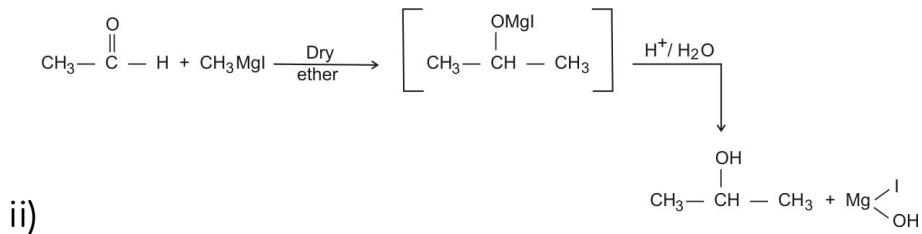
(b) Write mechanism of the following reaction :

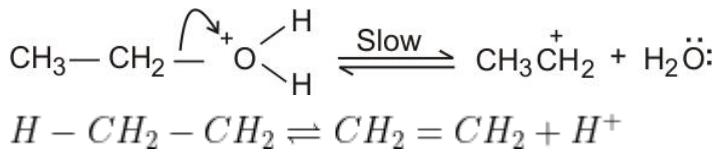


(c) Why phenol undergoes electrophilic substitution more easily than benzene ?



Ans. a) i) (Phenol)





2) (a) Account for the following:

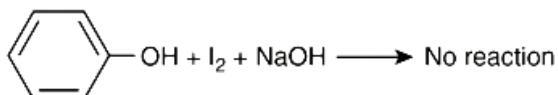
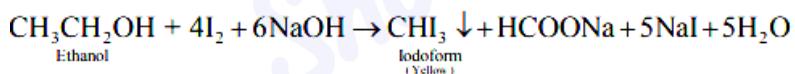
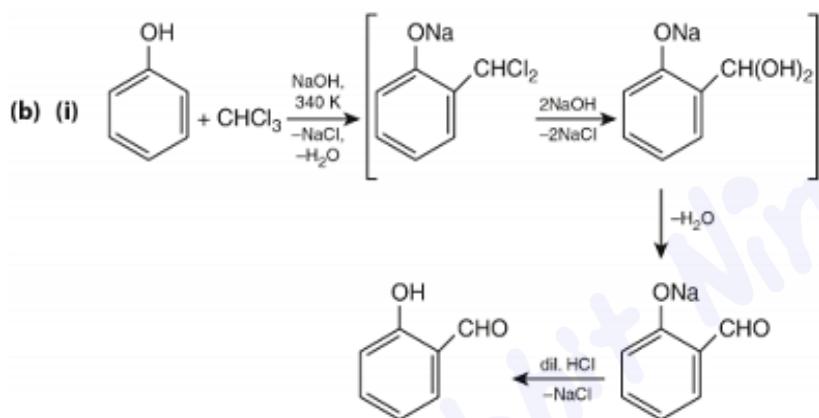
- (i) o-nitrophenol is more steam volatile than p-nitrophenol.
- (ii) t-butyl chloride on heating with sodium methoxide gives 2-methylpropene instead of t-butylmethylether.

(b) Write the reaction involved in the following:

- (i) Reimer-Tiemann reaction
- (ii) Friedel-Crafts Alkylation of Phenol

(c) Give simple chemical test to distinguish between Ethanol and Phenol.

Ans.



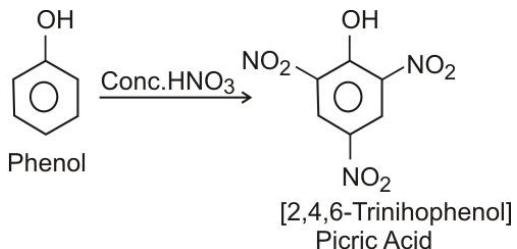
c) Phenol

3) (a) Give equations of the following reactions:

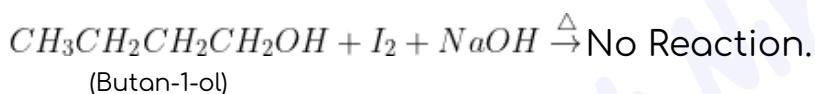
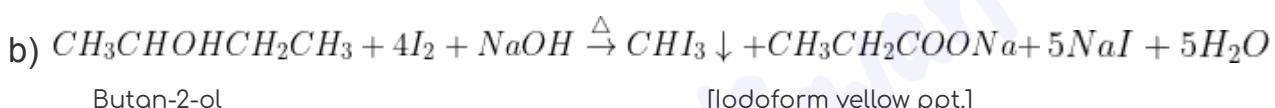
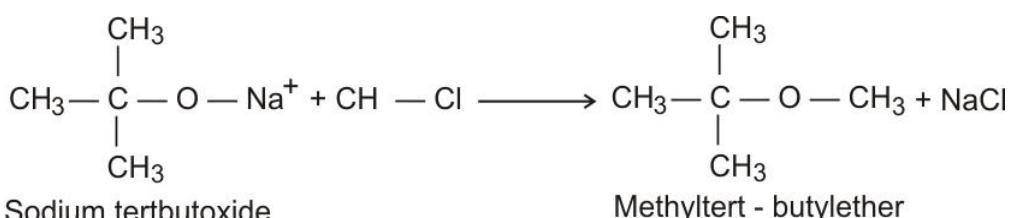
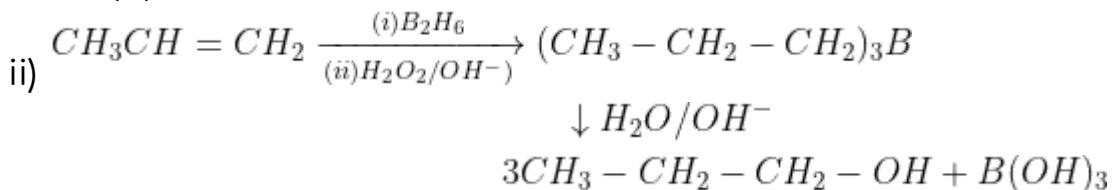
- (i) Phenol is treated with conc. HNO_3 .
- (ii) Propene is treated with B_2H_6 followed by $\text{H}_2\text{O}_2 / \text{OH}^-$.
- (iii) Sodium t-butoxide is treated with CH_3Cl .

(b) How will you distinguish between butan-1-ol and butan-2-ol?

(c) Arrange the following in increasing order of acidity: Phenol, ethanol, water.



Ans. a) i)



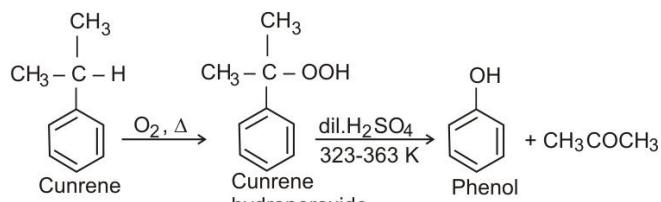
c) Ethanol < Water < Phenol

4) (a) How can you obtain Phenol from

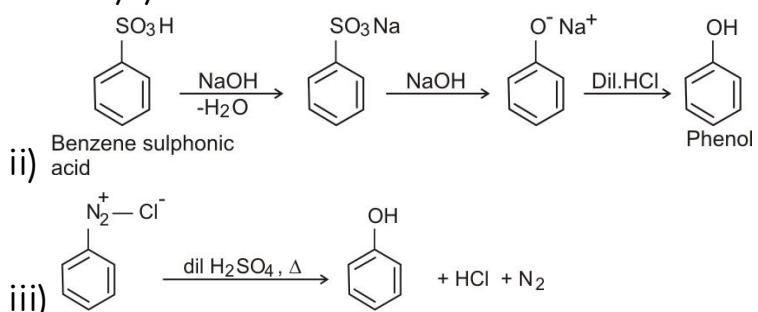
(i) Cumene, (ii) Benzene sulphonic acid, (iii) Benzene diazonium chloride?

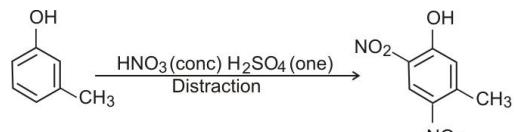
(b) Write the structure of the major product obtained from dinitration of 3-methylphenol.

(c) Write the reaction involved in Kolbe's reaction.

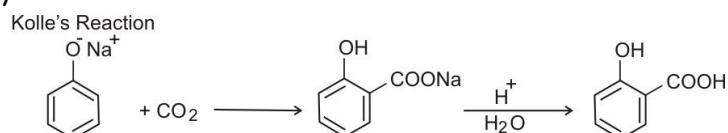


Ans. a) i)





b)



c)

Salicylic acid

5) Arrange the following in increasing order of their acidic character:

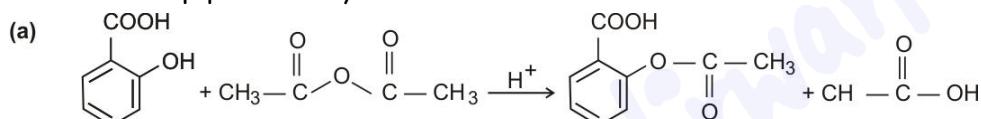
Benzoic acid, Phenol, Cresol

Ans. Cresol < phenol < benzoic acid

6) (a) What happens when Salicylic acid is treated with $(CH_3CO)_2O/H^+$?

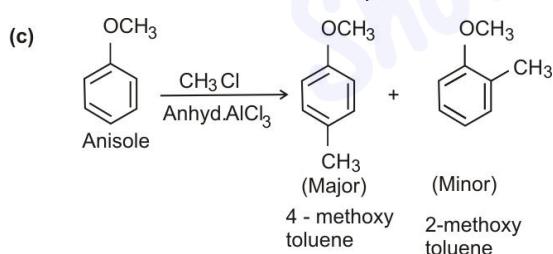
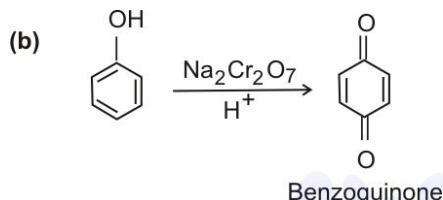
(b) Phenol is oxidised with $Na_2Cr_2O_7/H^+$?

(c) Anisole is treated with $CH_3Cl/\text{anhydrous AlCl}_3$? Write chemical equation in support of your answer.



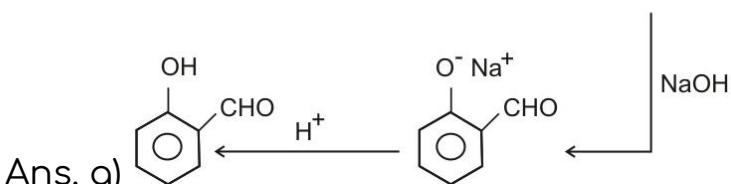
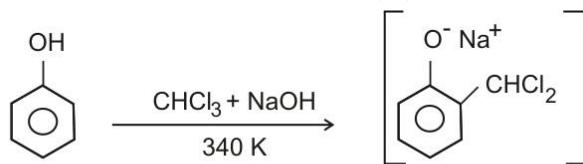
Ans.

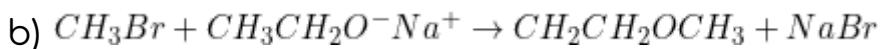
Salicylic



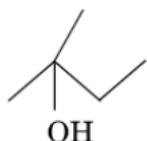
7) Define with equation:

(a) Reimer-Tiemann Reaction (b) Williamson's Synthesis

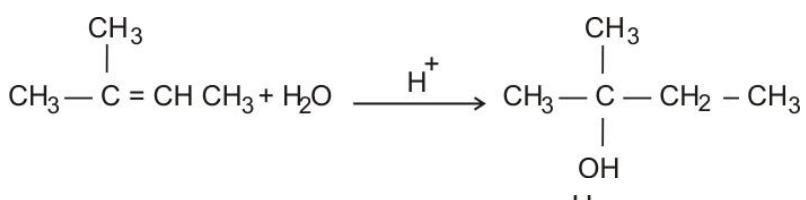
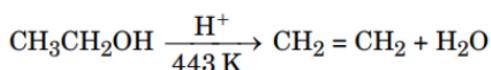




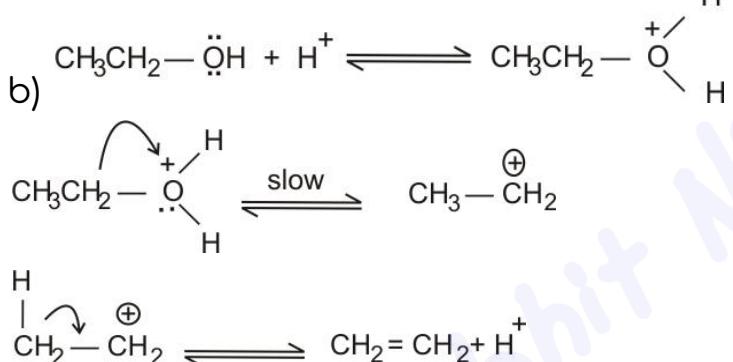
8) (a) How will you synthesise the following alcohol from appropriate alkene :



(b) Write the mechanism of the following reaction :



Ans. a)



9) An aromatic compound 'A' on treatment with $CHCl_3$ and KOH gives two compounds, both of which give same product 'B' when distilled with Zinc dust. Oxidation of 'B' gives 'C' with molecular formula $C_7H_6O_2$. Sodium salt of 'C' on heating with soda lime gives 'D' which may also be obtained by distilling 'A' with Zinc dust. Identify 'A', 'B', 'C' and 'D'.

Ans. 'A' is phenol (C_6H_5OH)

'B' is benzaldehyde (C_6H_5CHO)

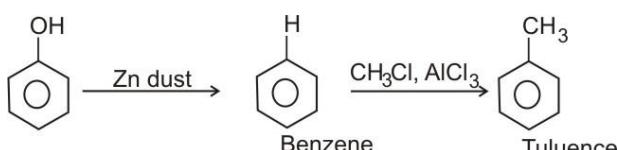
'C' is benzoic acid (C_6H_5COOH).

'D' is benzene (C_6H_6)

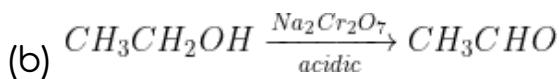
10) How do you convert the following:

(a) Phenol to Toluene

(b) Ethanol to Ethanal



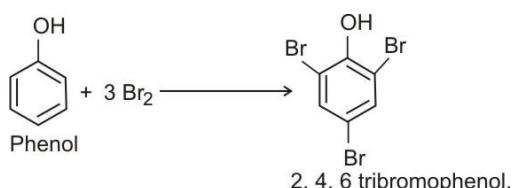
Ans. (a)



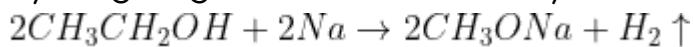
11) Give one chemical test to distinguish between the following:

- (a) Phenol and 1-propanol
- (b) Ethanol and dimethyl ether
- (c) 1-propanol and 2-Methyl-2-propanol

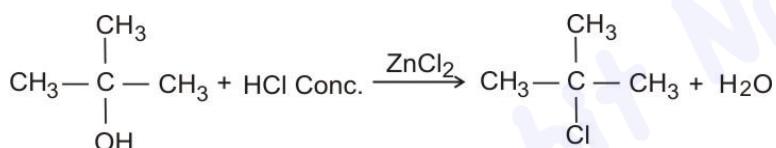
Ans. a) Phenol reacts with Bromine water to form white precipitates, whereas alcohol does not react.



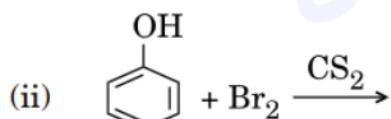
(b) Ethanol being acidic in nature reacts with sodium metal to release hydrogen gas whereas dimethyl ether does not react.



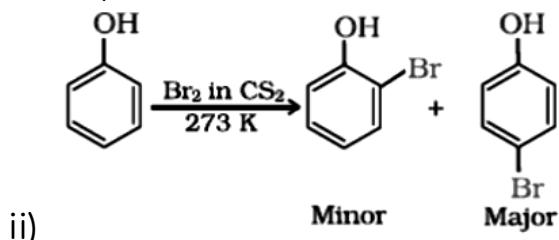
(c) 1-propanol being primary alcohol does not react with Lucas reagent. 2-methyl-2-propanol being tertiary alcohol immediately reacts with Lucas reagent to form alkyl halide and being insoluble, it produces turbidity in the solution.

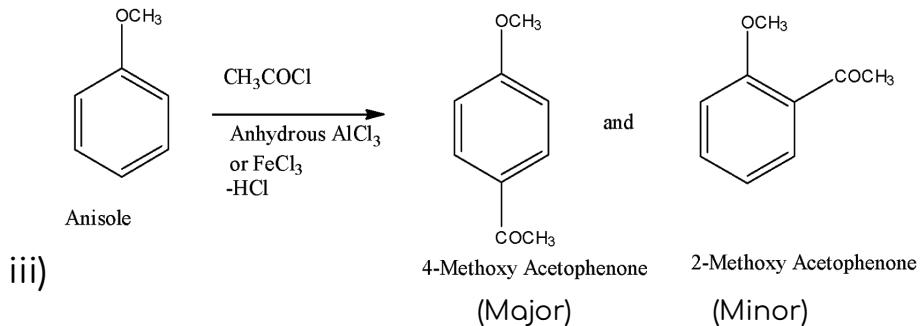


12) Write the products of the following reactions :



Ans. i) $\text{CH}_3\text{CH}_2\text{I} + \text{CH}_3\text{OH}$





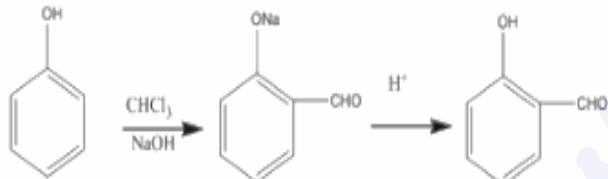
2022

1) (a) Out of t-butyl alcohol and n-butanol, which one will undergo acid catalyzed dehydration faster and why ?

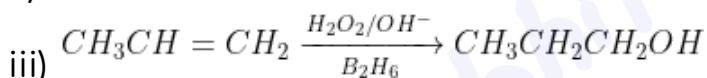
(b) Carry out the following conversions :

- (i) Phenol to Salicylaldehyde
- (ii) t-butylchloride to t-butyl ethyl ether
- (iii) Propene to Propanol

Ans. a) t-butyl alchoho



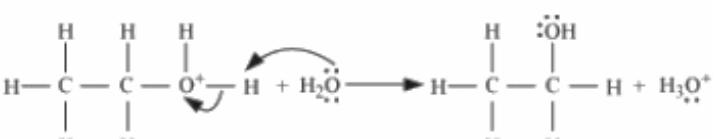
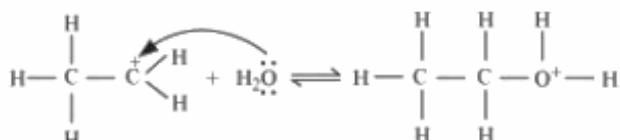
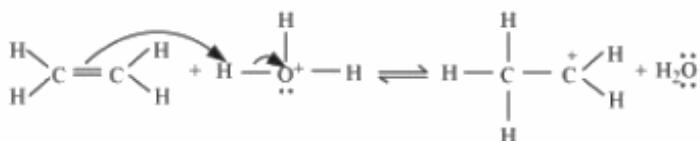
b) i)



2) (a) Give the mechanism for the formation of ethanol from ethene.

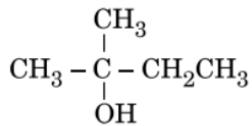
(b) Predict the reagent for carrying out the following conversions :

- (i) Phenol to benzoquinone
- (ii) Anisole to ρ -bromoanisole
- (iii) Phenol to 2,4,6-tribromophenol



Ans. a)

- b) (i) $K_2Cr_2O_7 + H_2SO_4$
(ii) Br_2 in CH_3COOH
(iii) Br_2 aq. / Bromine water



3) The correct IUPAC name of is

- (A) tert-butyl alcohol
(B) 2,2-Dimethylpropanol
(C) 2-Methylbutan-2-ol
(D) 3-Methylbutan-3-ol

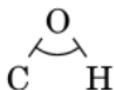
Ans. (C)

4) Assertion (A): o-nitrophenol is a weaker acid than p-nitrophenol.

Reason (R): Intramolecular hydrogen bonding makes ortho isomer weaker than para isomer.

Ans. Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

3) Give reasons for the following:



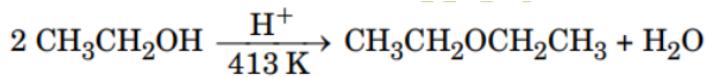
- a) Bond angle in alcohol is slightly less than the tetrahedral angle.
b) C-OH bond length in CH_3OH is slightly more than the C-OH bond length in phenol.

4) Assertion (A): The C-O-H bond angle in alcohols is slightly less than the tetrahedral angle.

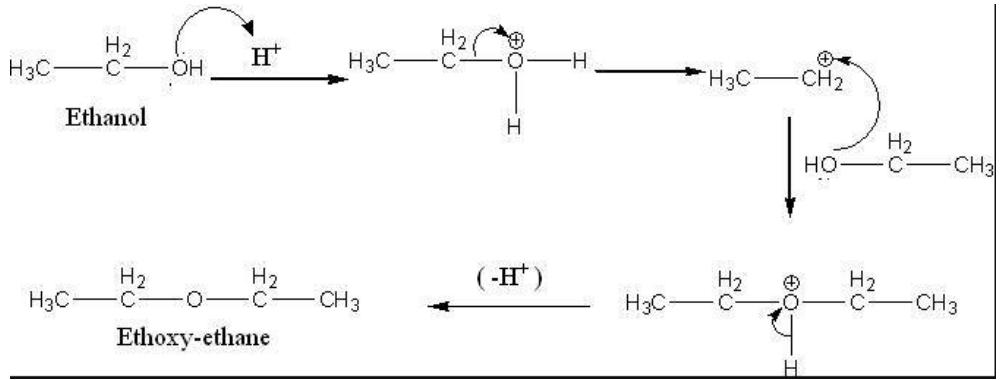
Reason (R): This is due to the repulsive interaction between the two lone electron pairs on oxygen.

Ans. Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

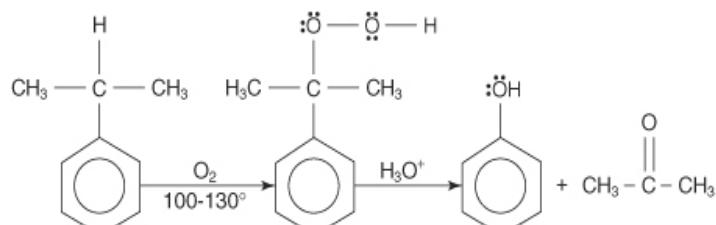
5) (a) Write the mechanism of the following reaction:



(b) Write the preparation of phenol from cumene



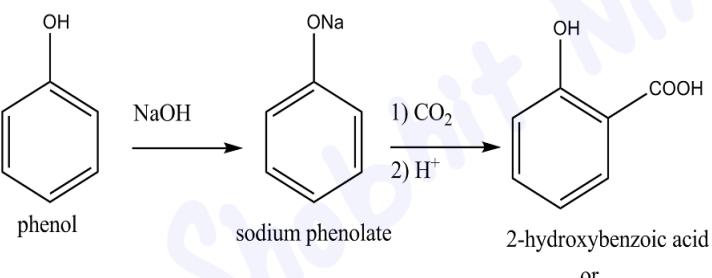
Ans. a)



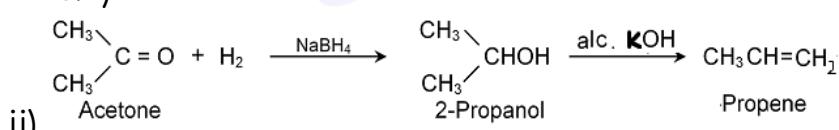
b)

6) How can you convert the following?

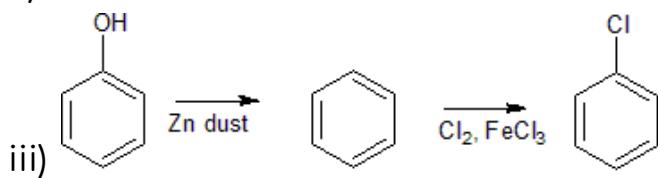
- (i) Sodium phenoxide to o-hydroxybenzoic acid
- (ii) Acetone to propene
- (iii) Phenol to chlorobenzene



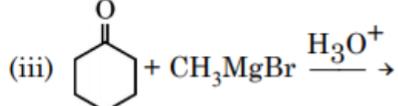
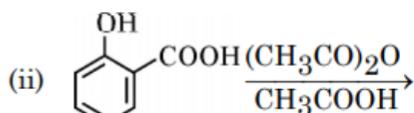
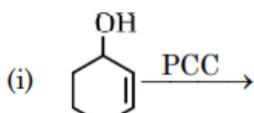
Ans. i)



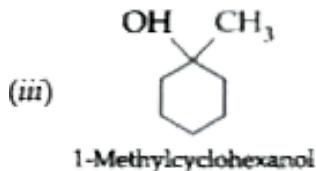
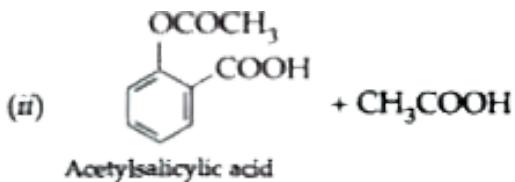
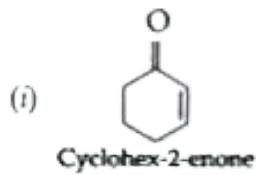
ii)



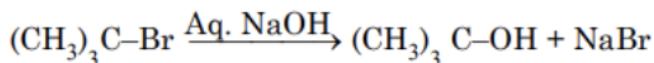
7) Write the product(s) of the following reactions:



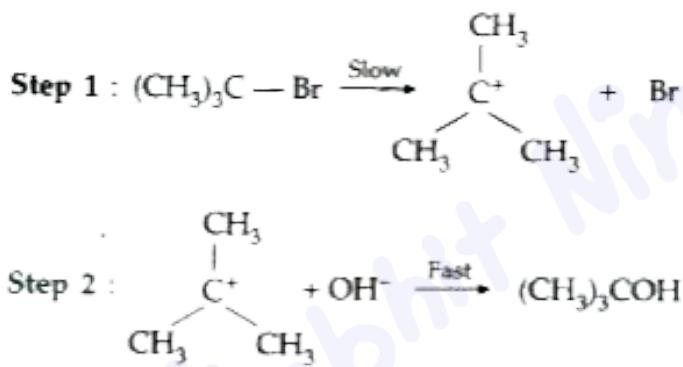
Ans.



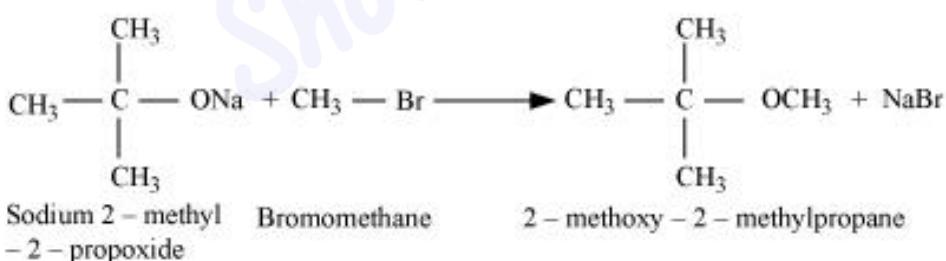
8) (a) Write the mechanism of the following SN1 reaction:



(b) Write the equation for the preparation of 2-methyl-2-methoxypropane by Williamson synthesis.



Ans. a)



b)

9) Assertion (A): The C-O-C bond angle in ethers is slightly less than tetrahedral angle.

Reason (R): Due to the repulsive interaction between the two alkyl groups in ethers.

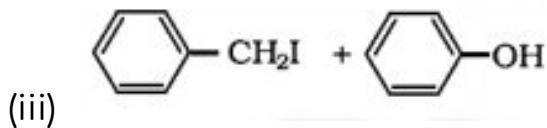
Ans. Assertion is wrong statement but reason is correct statement

10) Give the structures of final products expected from the following reactions:

- (i) Hydroboration of propene followed by oxidation with H₂O₂ in alkaline medium.
(ii) Dehydration of (CH₃)₃C-OH by heating it with 20% H₃PO₄ at 358 K

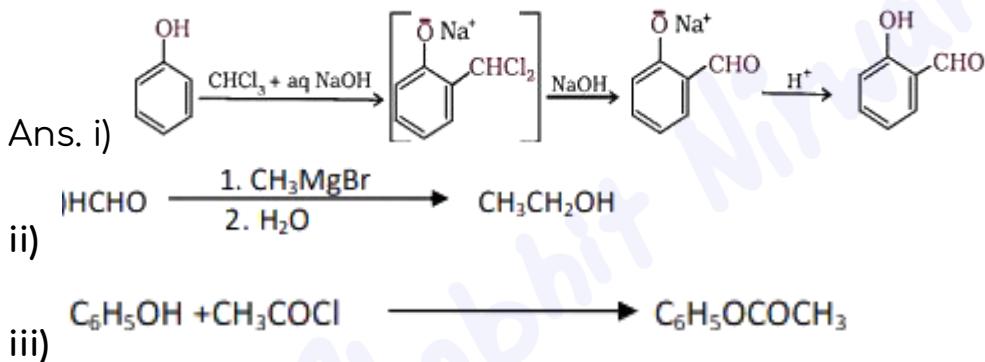
(iii) Heating of with HI.

Ans. (i) CH₃CH₂CH₂OH
(ii) (CH₃)₂C=CH₂



11) How can you convert the following?

- (i) Phenol to o-hydroxybenzaldehyde.
(ii) Methanal to ethanol
(iii) Phenol to phenyl ethanoate.



SOLUTIONS

2007

1) State the condition resulting in reverse osmosis?

2) A 0.1539 molal aqueous solution of cane sugar (mol. Mass = 342 g mol⁻¹) has a freezing point of 271 K, while the freezing point of pure water is 273.15 K. What will be the freezing point of an aqueous solution containing 5 g of glucose (mol mass = 180 g mol⁻¹) per 100 g of solution?

Ans. 263.27K

2008

1) State Raoult's law for solutions of volatile liquid components. Taking a suitable example, explain positive deviation from Raoult's law.

2) A solution containing 8g of a substance in 100g of diethyl ether boils at 36.86°C, whereas pure ether boils at 35.60°C. Determine the molecular mass of the solute. (For ether, $K_b = 2.02 \text{ K kg/mol}$)

Ans. 128.25 g mol⁻¹

3) State the law co-relating the pressure of a gas and its solubility in a liquid. State an application of this law.

Ans. Henry's law

4) Define the term osmotic pressure. Describe how the molecular mass of a substance can be determined on the basis of osmotic pressure measurement.

$$M_B = \frac{W_B RT}{\pi V}$$

Ans. π - osmotic pressure

5) Calculate the temperature at which a solution containing 54 g glucose in 250 g water will freeze. (K_f for water is 1.86 K Kg mol⁻¹)

Ans. 2.23°C

2009

1) Define:

a) Mole fraction b) van't Hoff factor

2) 100mg of a protein is dissolved in enough water to make 10.0ml of a solution. If this solution has an osmotic pressure of 13.3mm Hg at 25°C, what is the molar mass of the protein? ($R=0.0821 \text{ L atm K}^{-1}\text{mol}^{-1}$ and 760mm Hg = 1 atm.)

Ans. $13980.45 \text{ g mol}^{-1}$

3) What is meant by :

a) Colligative properties b) Molality of a solution

4. What conc. of nitrogen should be present in a glass of water at room temp?

Assume a temp of 25°C , a total pressure of 1 atmosphere and mol fraction of nitrogen in air of 0.78 (K_H for nitrogen = $8.42 \times 10^{-7} \text{ M / mm Hg}$)

Ans. $6.59 \times 10^7 \text{ mol L}^{-1}$

2010

1) Define osmosis and osmotic pressure? What is the advantage of using osmotic pressure over other colligative properties?

2) What mass of NaCl (58.5 g/mol) must be dissolved in 65g water to lower the freezing point by 7.5°C ? $K_f = 1.86 \text{ K Kg/mol}$ and I for NaCl = 1.86

Ans. 8.199 g

3) Differentiate between molarity and molality of a solution.

4) 15 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution freezes at -0.34°C . What is the molar mass of the substance?

($K_f = 1.86 \text{ K Kg mol}^{-1}$)

Ans. 182.35 gm / mol

5) What mass of ethylene glycol (molar mass = 62.0 g mol^{-1}) must be added to 5.50 Kg of water to lower the freezing point of water from 0°C to -10.0°C ?

($K_f = 1.86 \text{ K Kg mol}^{-1}$)

Ans. 1.833 kg

2011

1) State:

i) Raoult's law in its general form in reference to solutions.

ii) Henry's law about partial pressure of a gas in a mixture.

2) A solution is prepared by dissolving 8.95mg of a gene fragment in 35ml of water has an osmotic pressure of 0.335 torr at 25°C . Calculate its molar mass if it is a non electrolyte.

Ans. $1.42 \times 10^4 \text{ gm}$

3) What is reverse osmosis?

4) Difference between molarity and molality values for a solution. What is the effect of change in temperature on molarity and molality values.

5) What mass of NaCl (58.5 g/mol) must be dissolved in 65g water to lower the freezing point by 7.5°C ? $K_f = 1.86 \text{ K Kg/mol}$ and i for NaCl = 1.86

Ans. 8.199 g

2012

1) Define the following terms:

(i) Mole fraction (ii) Ideal Solution

2) 15 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution freezes at -0.34°C . What is the molar mass of the substance? ($K_f = 1.86 \text{ K Kg mol}^{-1}$)

Ans. 182.35 gm / mol

3) Explain the following :

(i) Henry's Law about dissolution of gas in liquid
(ii) Boiling point elevation constant for a solvent

4) A solution of glycerol ($\text{C}_3\text{H}_8\text{O}_3$) in water was prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of 100.42°C . What mass of glycerol was dissolved to make this solution? (K_b for water = $0.512 \text{ K Kg mol}^{-1}$)

Ans. 37.73 g

2013

1) (a) State Raoult's law for a solution containing volatile components. How does Raoult's law become a special case of Henry's law?

(b) 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. Find the molar mass of the solute. (K_f for benzene = $5.12 \text{ K kg mol}^{-1}$)

Ans. b) 256 g/mol

2) Define the following terms :

(i) Ideal solution (ii) Azeotrope (iii) Osmotic pressure

3) A solution of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in water is labelled as 10% by weight. What would be the molality of the solution? (Molar mass of glucose = 180 g mol $^{-1}$)

Ans. 0.6 molal

2014

1) a) Define the following terms:

i) Molarity ii) Molal elevation constant (K_b)

b) A solution containing 15 g urea (molar mass = 60 g/mol) per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molar mass = 180 g/mol) in water. Calculate the mass of glucose present in one litre of its solution.

Ans. b) 45g

Or

a) What type of deviation is shown by mixture of ethanol and acetone? Give reason.

b) A solution of glucose (molar mass = 180 g/mol) in water is labelled as 10% (by mass). What would be the molality and molarity of the solution? (Density of solution = 1.2 g/mL)

Ans. b) 0.61 m or 0.61 mol/kg, 0.66 M or 0.66 mol/L

2015

1) On mixing liquid X and liquid Y, the volume of the resulting solution increases. What type of deviation from Raoult's law is shown by the resulting solution? What change in temperature would you observe after mixing liquids X and Y?

Ans. boiling point of the solution decreases

2) How can the direction of osmosis be reversed ? Write one use of reverse osmosis.

3) A solution is prepared by dissolving 5 g of non volatile solute in 95 g of water. It has a vapour pressure of 23.375 mm Hg at 25°C. Calculate the molar mass of the solute. (Vapour pressure of pure water at 25°C is 23.75 mm Hg)

Ans. 95.05 g

2016

1) Write two differences between a solution showing positive deviation and a solution showing negative deviation from Raoult's law.

2) Calculate the freezing point of a solution when 3g of CaCl_2 ($M = 111 \text{ g mol}^{-1}$) was dissolved in 100 g of water, assuming CaCl_2 undergoes complete ionization. (K_f for water = $1.86 \text{ K kg mol}^{-1}$)

Ans. 271.64 K

2017

1) A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K. (Molar mass of sucrose = 342 g mol⁻¹, Glucose = 180 g mol⁻¹)

Ans. 265.55 K

2) Define a) Molality (m)

b) Abnormal molar mass

c) 30 g of urea ($M = 60 \text{ g mol}^{-1}$) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

d) Write two differences between ideal and non-ideal solutions.

Ans. c) 23.55 mm Hg

2018

1) Calculate the freezing point of a solution containing 60 g of glucose (Molar mass = 180 g mol $^{-1}$) in 250 g of water. (K_f of water = 1.86 K kg mol $^{-1}$)

Ans. 270.67 K

2) Give reasons for the following:

(a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.

(b) Aquatic animals are more comfortable in cold water than in warm water.

(c) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.

2019

1) State Raoult's law for a solution containing volatile components. Write two characteristics of the solution which obeys Raoult's law at all concentrations.

2) A 4 % solution (w/w) of sucrose ($M = 342 \text{ g mol}^{-1}$) in water has a freezing point of 271.15 K. Calculate the freezing point of 5 % glucose ($M = 180 \text{ g mol}^{-1}$) in water.

Ans. 268.4 K

3) Give reasons :

(a) Cooking is faster in pressure cooker than in cooking pan.

(b) Red Blood Cells (RBC) shrink when placed in saline water but swell in distilled water.

4) A solution containing 1.9 g per 100 mL of KCl ($M = 74.5 \text{ g mol}^{-1}$) is isotonic with a solution containing 3 g per 100 mL of urea ($M = 60 \text{ g mol}^{-1}$).

Calculate the degree of dissociation of KCl solution. Assume that both the solutions have same temperature.

Ans. 0.92

5) (a) Out of 0.1 molal aqueous solution of glucose and 0.1 molal aqueous solution of KCl, which one will have higher boiling point and why?

(b) Predict whether van't Hoff factor (i) is less than one or greater than one in the following:

- (i) CH₃COOH dissolved in water
- (ii) CH₃COOH dissolved in benzene

Ans. a) 0.1 molal aqueous solution of KCl

b) i. i>1

ii. i<1

6) A solution 0.1 M of Na₂SO₄ is dissolved to the extent of 95%. What would be its osmotic pressure at 27°C? (R = 0.0821 Latm K⁻¹mol⁻¹)

Ans. 7.14 atm

7) Give reasons for the following:

(a) Aquatic species are more comfortable in cold water than warm water.

(b) At higher altitudes people suffer from anoxia resulting in inability to think.

(OR)

What type of azeotropic mixture will be formed by a solution of acetone and chloroform? Justify on the basis of strength of intermolecular interactions that develop in the solution.

Ans. A maximum boiling azeotropic mixture

8) At 300 K, 30 g of glucose present in a litre of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of a glucose solution is 1.52 bar at the same temperature, what would be its concentration?

Ans. 0.0508 M

9) (a) Draw the graph between vapour pressure and temperature and explain the elevation in boiling point of a solvent in solution.

(b) Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K₂SO₄ in 2 litres of water at 25°C assuming it to be completely dissociated. (Atomic masses K=39u, S=32u, O=16u)

Ans. b) 1.76×10^{-3} atm

(OR)

(a) Write two characteristics of non-ideal solution.

(b) 2 g of benzoic (C₆H₅COOH) dissolved in 25 g of benzene shows a depression in freezing point equal to 1.62K. Molal depression constant

for benzene is $4.9 \text{ K kg mol}^{-1}$. What is the percentage association of acid if it forms dimer in solution?

Ans. 99.2%

2020

1) For a 5% solution of urea (Molar mass = 60 g/mol), calculate the osmotic pressure at 300 K. [$R = 0.0821 \text{ L atm K}^{-1}\text{mol}^{-1}$]

Ans. 20.52 atm

(OR)

Visha took two aqueous solutions — one containing 7.5 g of urea (Molar mass = 60 g/mol) and the other containing 42.75 g of substance Z in 100 g of water, respectively. It was observed that both the solutions froze at the same temperature. Calculate the molar mass of Z.

Ans. 342 g/mol

2) Identify which liquid will have a higher vapour pressure at 90°C if the boiling points of two liquids A and B are 140°C and 180°C , respectively.

Ans. A > B

3) 50 mL of an aqueous solution of glucose $\text{C}_6\text{H}_{12}\text{O}_6$ (Molar mass: 180 g/mol) contains 6.02×10^{22} molecules. The concentration of the solution will be

(A) 0.1 M (B) 0.2 M (C) 1.0 M (D) 2.0 M

Ans. (D)

4) Predict the state of the solute in the solution in the following situations:

(a) When 'i' is found to be more than one.

(b) When 'i' is found to be less than one

Ans. (a) Dissociated.

(b) Associated

5) Assertion (A): Osmotic Pressure is a colligative Property.

Reason (R) : Osmotic pressure is directly proportional to molarity.

Ans. Both A and R are true and R is the correct explanation of A

6) (a) A solution contains 5.85 g NaCl (Molar mass = 58.5 g mol⁻¹) per litre of solution. It has an osmotic pressure of 4.75 atm at 27°C . Calculate the degree of dissociation of NaCl in this solution. (Given : $R = 0.082 \text{ L atm K}^{-1}\text{mol}^{-1}$)

(b) State Henry's law. Why is air diluted with helium in the tanks used by scuba divers ?

Ans. a) 1.93

OR

(a) When 19.5 g of F CH₂-COOH (Molar mass = 78 g mol⁻¹) is dissolved in 500 g of water, the depression in freezing point is observed to be 1°C. Calculate the degree of dissociation of [Given : K_f for water 1.86 K kg mol⁻¹]

(b) Give reasons :

- (i) 0.1 M KC1 has higher boiling point than 0.1 M Glucose.
- (ii) Meat is preserved for a longer time by salting.

Ans. a) the van't Hoff factor is 1.0753 and dissociation constant is 3.07×10^{-3}

7) What happens when

- (i) a pressure greater than osmotic pressure is applied on the solution side separated from solvent by a semipermeable membrane?
- (ii) acetone is added to pure ethanol.

8) State Henry's law. Calculate the solubility of CO₂ in water at 298 K under 760 mm Hg. (KH for CO₂ in water at 298 K is 1.25 106 mm Hg)

Ans. 0.033 mol/litre

9) The freezing point of a solution containing 5g of benzoic acid (M = 122 g mol⁻¹) in 35g of benzene is depressed by 2.94 K. What is the percentage association of benzoic acid if it forms a dimer in solution? (K_f for benzene = 4.9 K kg.mol⁻¹)

Ans. 97.6 percent

10) State Raoult's law for a solution containing volatile components. What is the similarity between Raoult's law and Henry's law?

11) A 0.01 m aqueous solution of AlCl₃ freezes at - 0.068°C. Calculate the percentage of dissociation. [Given : K_f for Water = 1.86 K kg mol⁻¹]

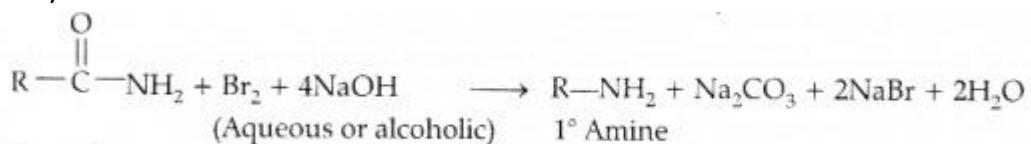
Ans. 88.53%

ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

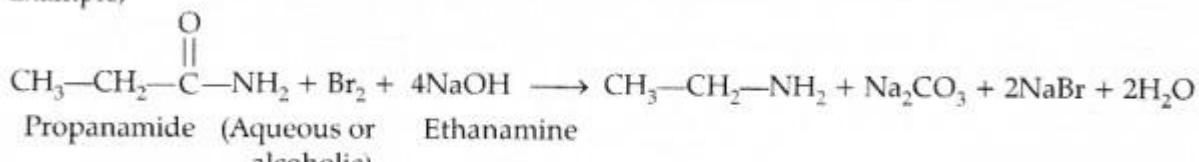
2016

1) Write the chemical equations involved in the following reactions:

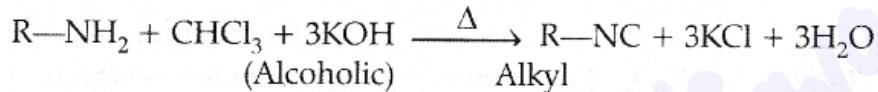
- a) Hoffmann-bromamide degradation reaction
- b) Carbylamine reaction



Example,

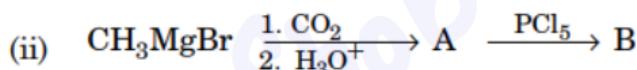


Ans. i)



ii)

2) (a) Write the structures of A and B in the following reactions :



(b) Distinguish between :

(i) $\text{C}_6\text{H}_5-\text{COCH}_3$ and $\text{C}_6\text{H}_5-\text{CHO}$

(ii) CH_3COOH and HCOOH

(c) Arrange the following in the increasing order of their boiling points

CH_3CHO , CH_3COOH , $\text{CH}_3\text{CH}_2\text{OH}$



(B) (i) Acetophenone, $\text{C}_6\text{H}_5-\text{COCH}_3$

Ans. Benzaldehyde $\text{C}_6\text{H}_5-\text{CHO}$

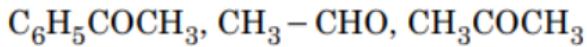
(ii) CH₃COOH , acetic acid and HCOOH, propanoic acid

(c) CH₃HO < CH₃CH₂OH < CH₃COOH

OR

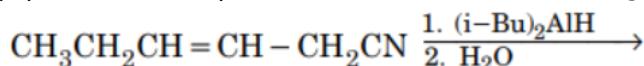
(a) Write the chemical reaction involved in Wolff-Kishner reduction.

(b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction :



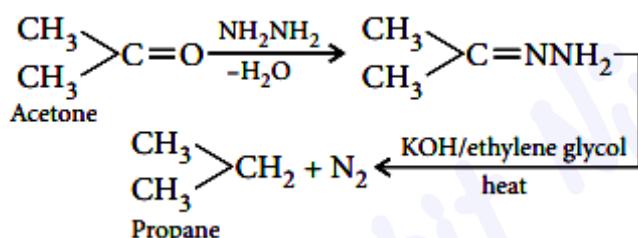
(c) Why carboxylic acid does not give reactions of carbonyl group ?

(d) Write the product in the following reaction



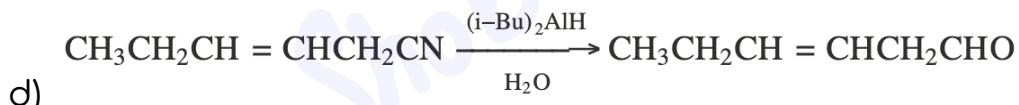
(e) A and B are two functional isomers of compound C₃H₆O. On heating with NaOH and I₂, isomer B forms yellow precipitate of iodoform whereas

isomer A does not form any precipitate. Write the formulae of A and B.



Ans. a)

b) C₆H₅COCH₃ < CH₃COCH₃ < CH₃CHO

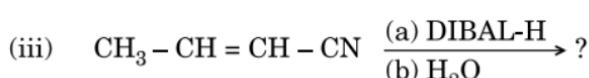
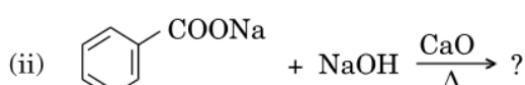
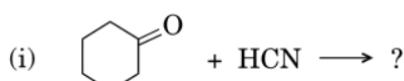


e) 'A' is CH₃CH₂CHO, 'B' is CH₃-C(=O)-CH₃.

2017

1) Write the products in the following reactions:

(a) Write the product(s) in the following reactions :



(b) Give simple chemical tests to distinguish between the following pairs of compounds:

- (i) Butanal and Butan-2-one
- (ii) Benzoic acid and Phenol

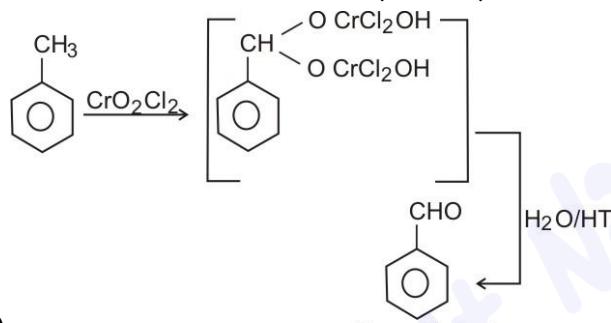


2) (a) Write the reactions involved in the following:

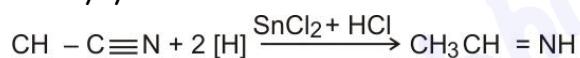
- i) Etard reaction
- ii) Stephen reduction

(b) How will you convert the following in not more than two steps:

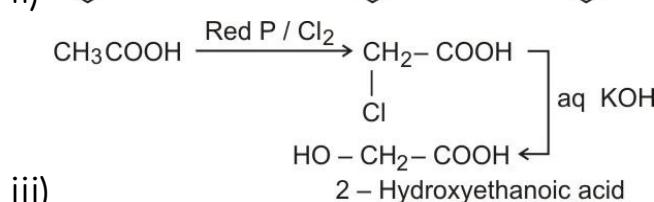
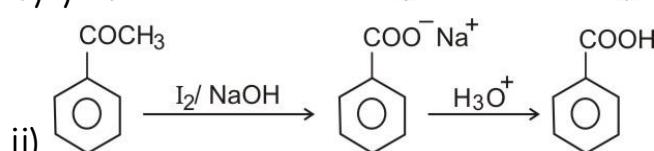
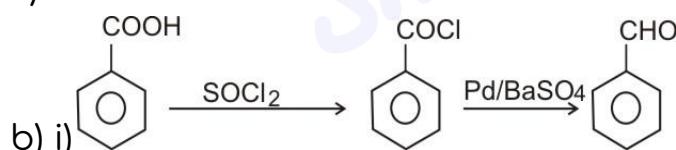
- i) Benzoic acid to Benzaldehyde
- ii) Acetophenone to Benzoic acid
- iii) Ethanoic acid to 2-Hydroxyethanoic acid



Ans. a) i)



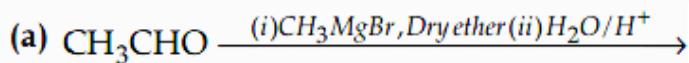
ii)



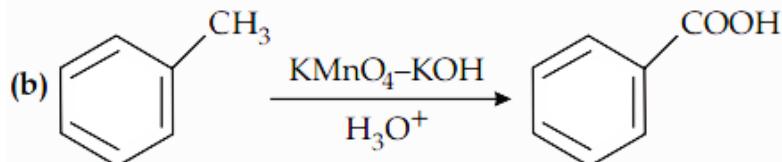
2018

1) How do you convert the following?

- (a) Ethanal to Propanone
- (b) Toluene to Benzoic acid



Ans. $\text{CH}_3\text{CH(OH)CH}_3 \xrightarrow{\text{CrO}_3} \text{CH}_3\text{COCH}_3$

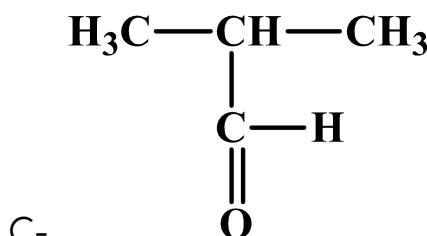
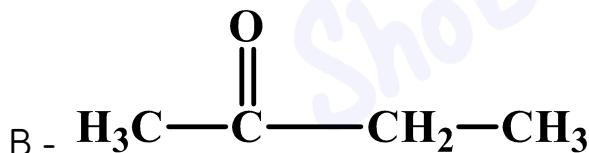
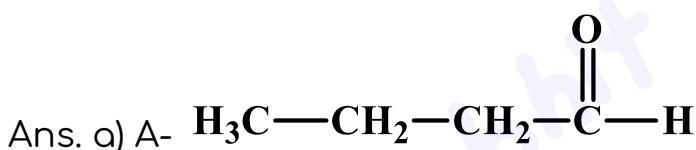


2) Account for the following:

- (a) Aromatic carboxylic acids do not undergo Friedel-Crafts reaction.
- (b) pK_a value of 4-nitrobenzoic acid is lower than that of benzoic acid

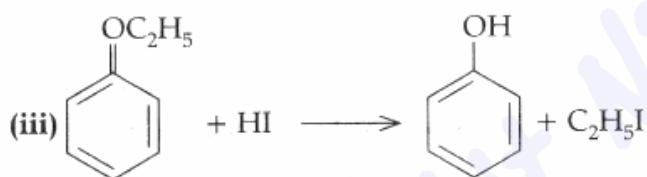
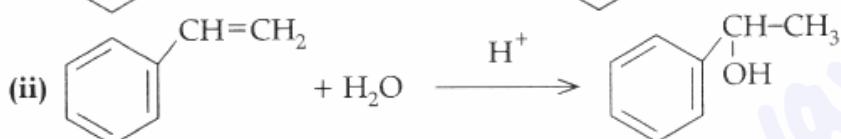
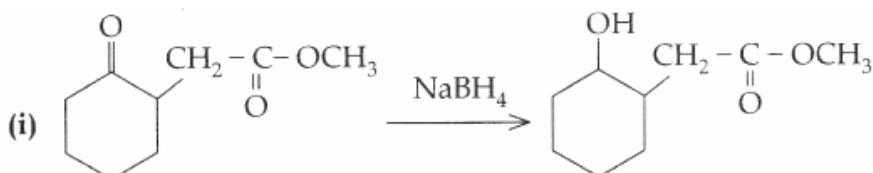
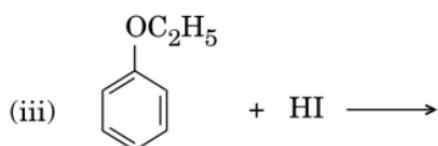
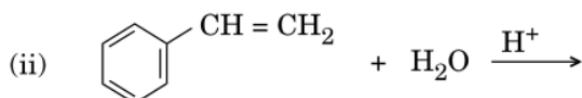
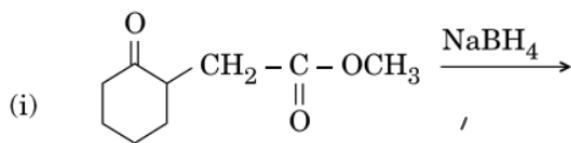
3) (A), (B) and (C) are three non-cyclic functional isomers of a carbonyl compound with molecular formula $\text{C}_4\text{H}_8\text{O}$. Isomers (A) and (C) give positive Tollens' test whereas isomer (B) does not give Tollens' test but gives positive Iodoform test. Isomers (A) and (B) on reduction with $\text{Zn(Hg)}/\text{conc. HCl}$ give the same product (D).

- (a) Write the structures of (A), (B), (C) and (D).
- (b) Out of (A), (B) and (C) isomers, which one is least reactive towards addition of HCN?



b) compound B is least reactive towards HCN addition reaction.

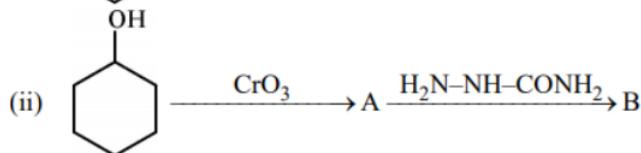
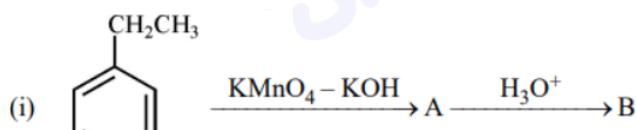
4) Write the structures of the main products in the following reactions

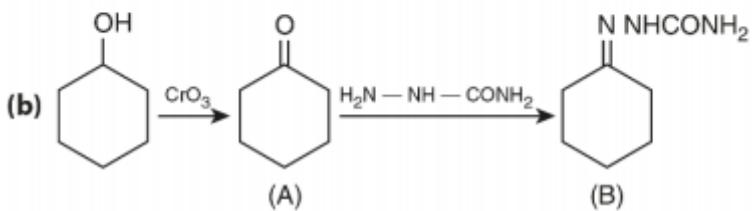
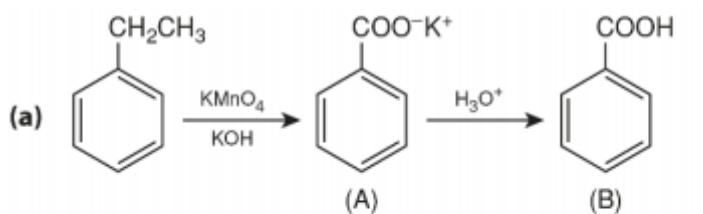


Ans.

2019

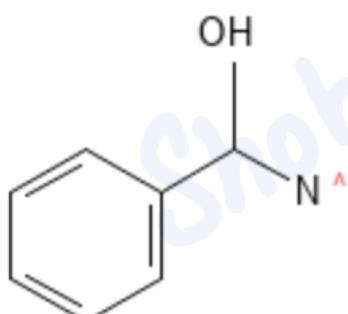
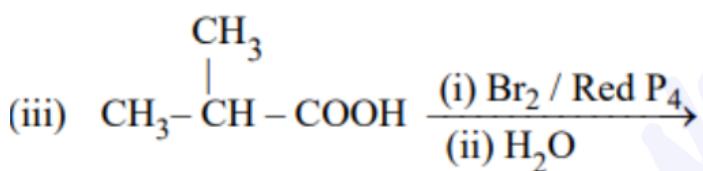
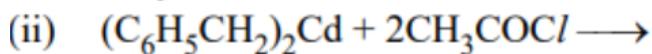
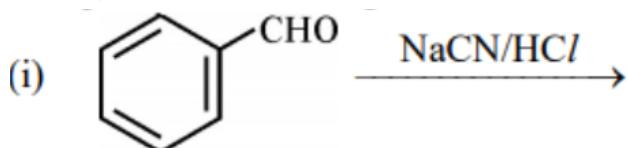
1) Write structures of compounds A and B in each of the following reactions:





Ans.

2) Complete the following reactions :



Ans. i) $C_6H_5CH_2CH_2CH_2NH_2 \cdot HCl$, ii) $2CH_3COCH_2C_6H_5 + CdCl_2$,
iii) $(CH_3)_2BrC-COOH$

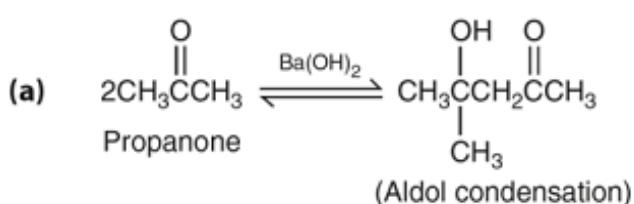
3) Write chemical equations for the following reactions:

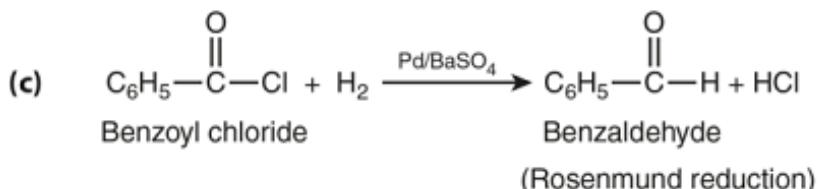
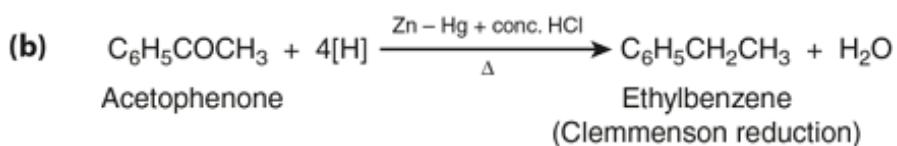
a) Propanone is treated with dilute $Ba(OH)_2$.

b) Acetophenone is treated with $Zn(Hg)/Conc.HCl$

c) Benzoyl chloride is hydrogenated in presence of $Pd/BaSO_4$.

Ans.





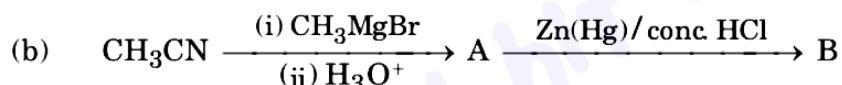
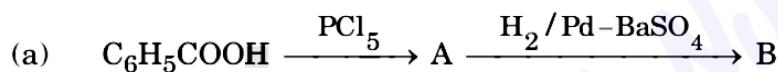
4) (a) Give reasons :

- (i) Benzoic acid is a stronger acid than acetic acid.
- (ii) Methanol is more reactive towards nucleophilic addition reaction than ethanal.

(b) Give a simple chemical test to distinguish between propanal and propanone.

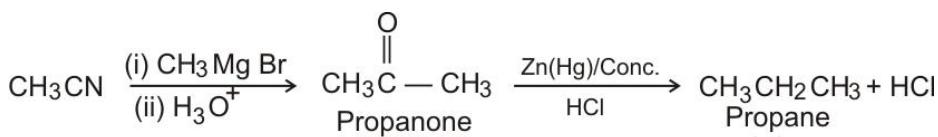
Ans. b) iodoform test.

2) Write structures of main compounds A and B in each of the following reactions :



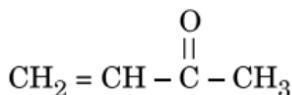
(A) (B)

Benzoylchloride Benzaldehyde



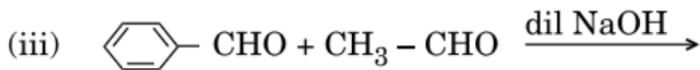
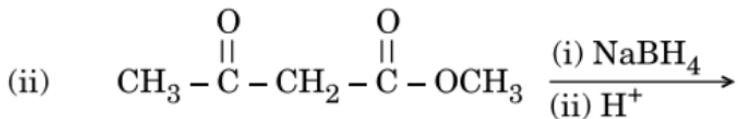
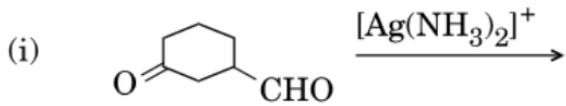
b) (B)

3) Write the IUPAC name of the following compound:

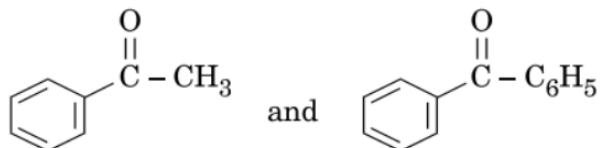


Ans. Butan-2-one

5) (a) Predict the main product of the following reactions :

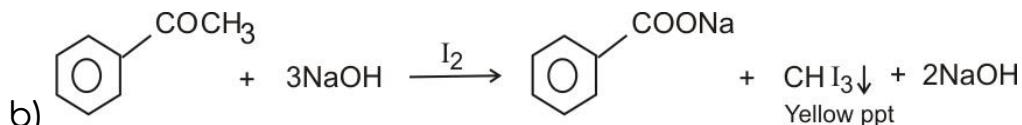
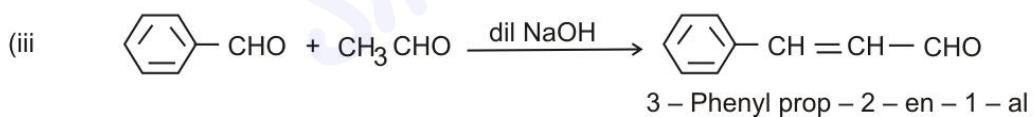
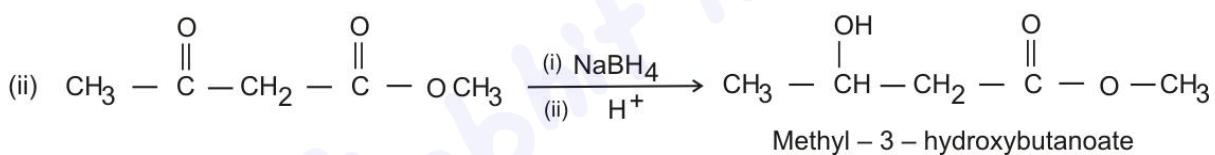
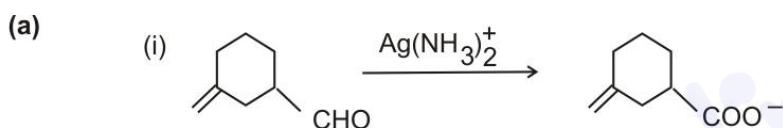


(b) Give a simple chemical test to distinguish between



(c) Why is alpha (α) hydrogen of carbonyl compounds acidic in nature ?

Ans.



but benzophenone one does not.

3) (a) Write the main product formed when propanal reacts with the following reagents :

(i) 2 moles of CH_3OH in presence of dry HCl

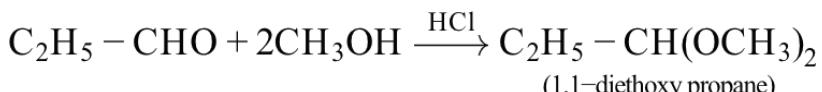
(ii) Dilute NaOH

(iii) $\text{H}_2\text{N-NH}_2$ followed by heating with KOH in ethylene glycol

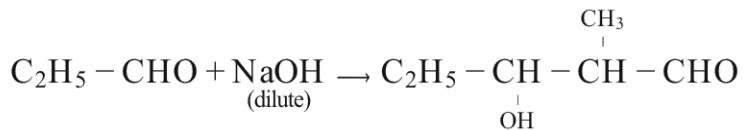
(b) Arrange the following compounds in increasing order of their property as indicated :

(i) $\text{F-CH}_2\text{COOH}$, $\text{O}_2\text{N-CH}_2\text{COOH}$, CH_3COOH , HCOOH — acid character

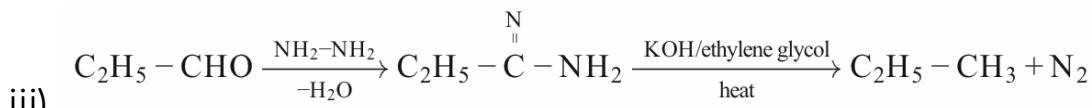
(ii) Acetone, Acetaldehyde, Benzaldehyde, Acetophenone — reactivity towards addition of HCN



Ans. i)



ii)



iii)
b)

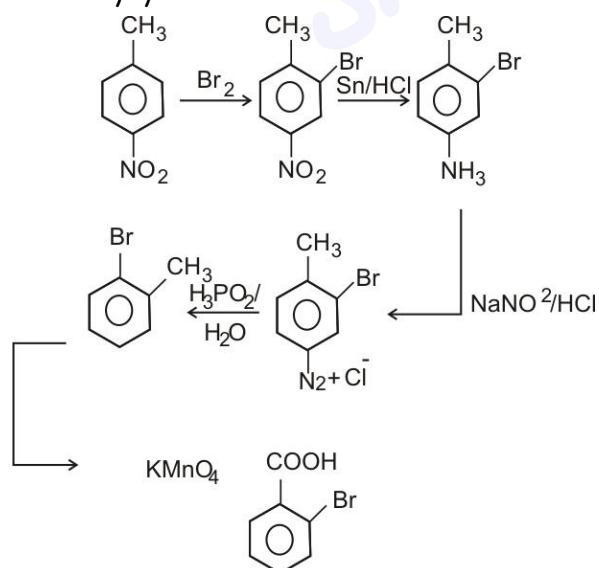


4) (a) Carry out the following conversions : (i) P-nitrotoluene to 2-bromobenzoic acid

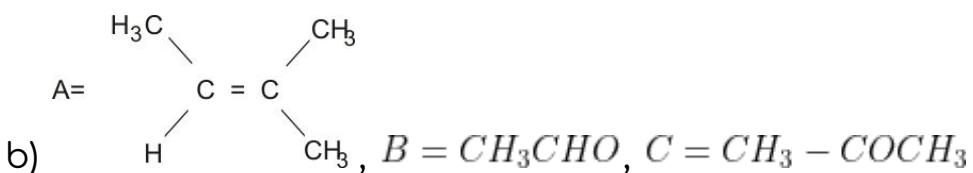
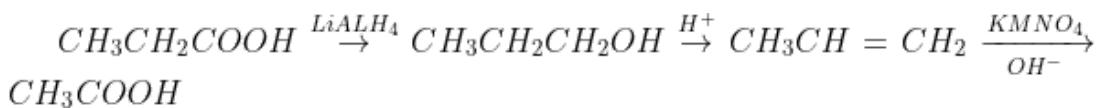
(ii) Propanoic acid to acetic acid

(b) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, B and C. Compound B gives positive Fehling test and also reacts with iodine and NaOH solution. Compound C does not give Fehling solution test but forms iodoform. Identify the compounds A, B and C.

Ans. a) i)

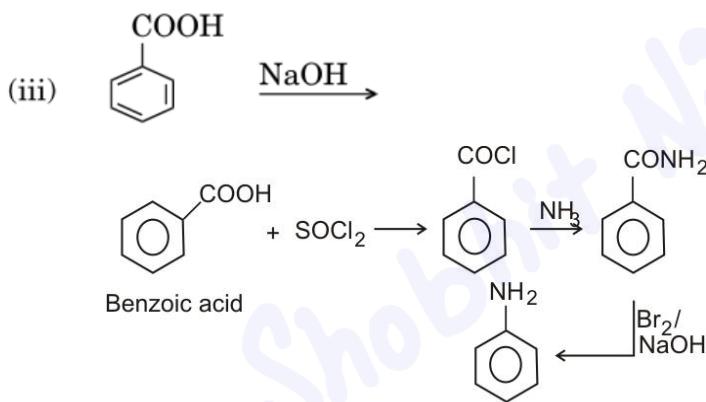
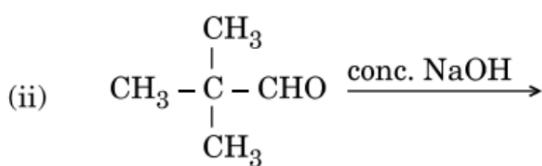
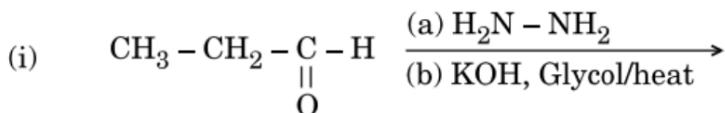


ii)

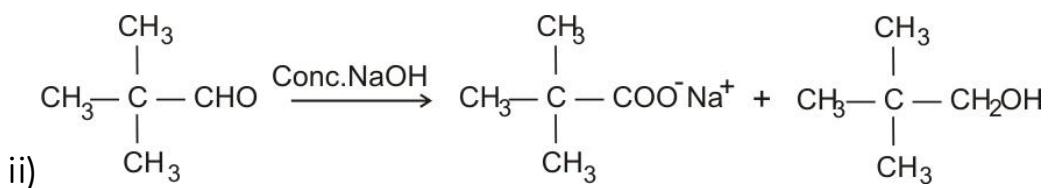
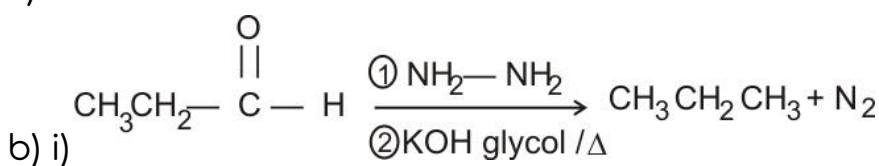
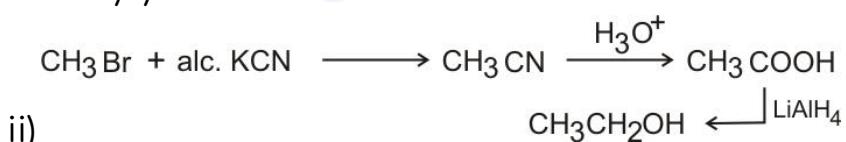


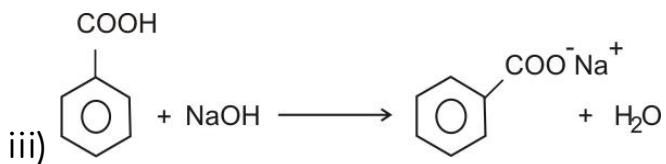
5) (a) Carry out the following conversions : (i) Benzoic acid to aniline (ii) Bromomethane to ethanol

(b) Write the structure of major product(s) in the following :



Ans. a) i)



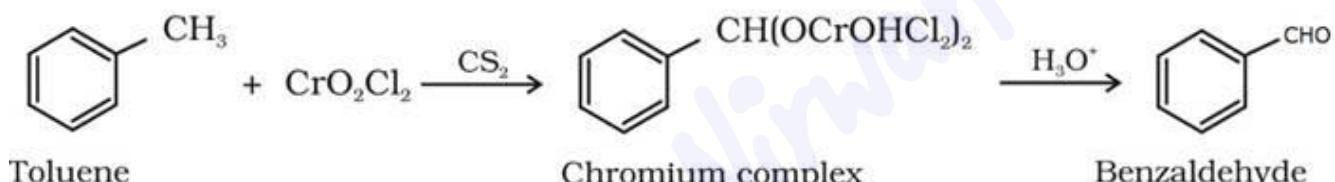


6) CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. Why?

- 7) (a) Give IUPAC name of $\text{CH}_3\text{-CH}=\text{CH-CHO}$.
 (b) How can you distinguish between ethanol and ethanal?
 (c) How will you convert the following:
 (i) Toluene to benzoic acid
 (ii) Ethanol to propan-2-ol
 (iii) Propanal to 2-hydroxypropanoic acid

Ans. a) but-2-enal

c) i)

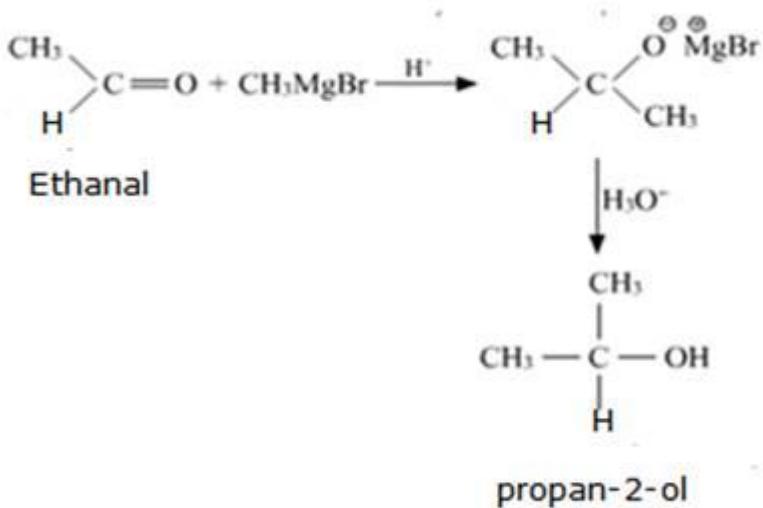
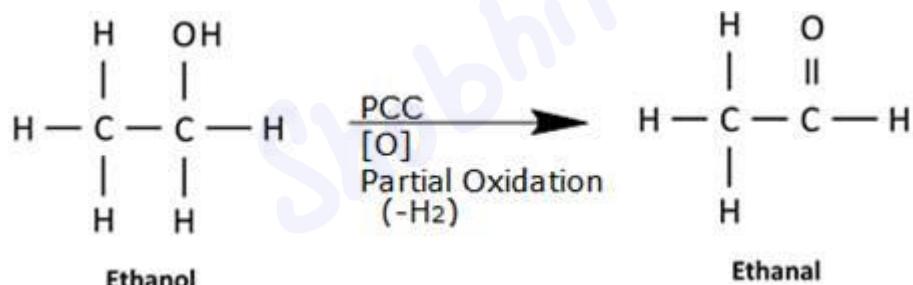


Toluene

Chromium complex

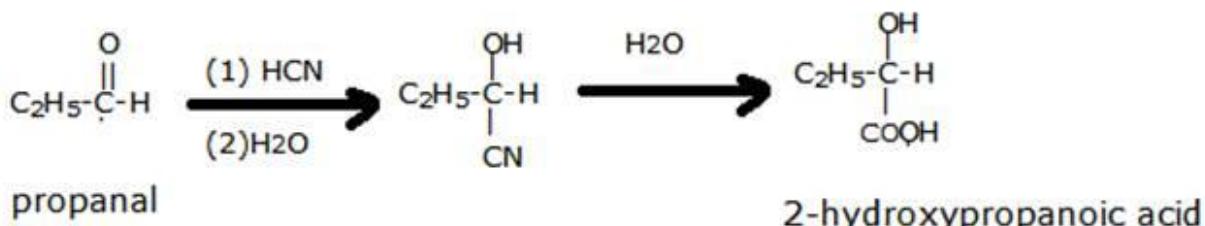
Benzaldehyde

ii)



propan-2-ol

iii)



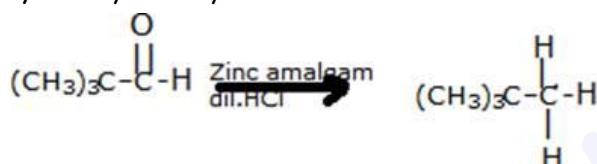
8) (a) Give IUPAC name of Salicylic acid.

(b) Chloroacetic acid is more acidic than acetic acid. Why?

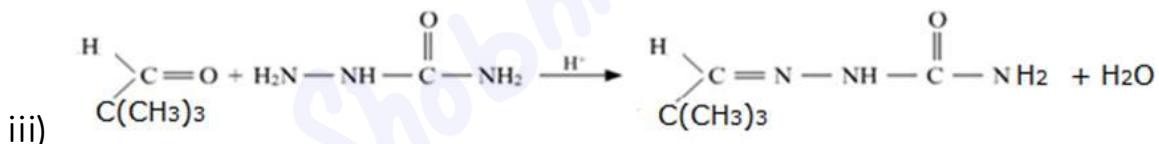
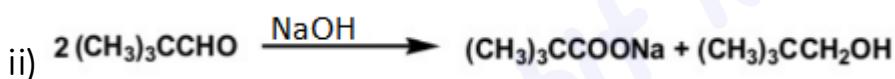
(c) Write the products formed when $(\text{CH}_3)_3\text{C}-\text{CHO}$ reacts with the following:

- (i) Zinc amalgam and dilute hydrochloric acid
- (ii) Concentrated sodium hydroxide solution
- (iii) Semicarbazide and a weak acid

Ans. a) 2-hydroxybenzoic acid.



c) i)



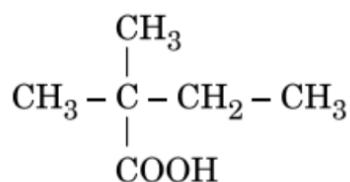
2020

1) Iodoform test is not given by

(A) Ethanol (B) Ethanal (C) Pentan-2-one (D) Pentan-3-one

Ans. (D)

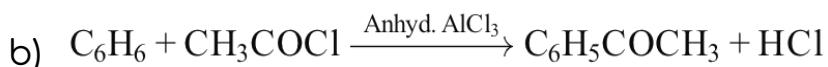
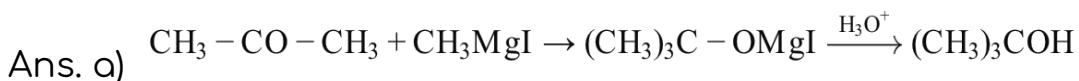
2) What is the correct IUPAC name of the given compound ?



- (A) 2,2-Dimethylbutanoic acid
- (B) 2-Carboxyl-2-methylbutane
- (C) 2-Ethyl-2-methylpropanoic acid
- (D) 3-Methylbutane carboxylic acid

Ans. (A)

3) What happens when (a) Propanone is treated with methylmagnesium iodide and then hydrolysed, and (b) Benzene is treated with CH_3COCl in presence of anhydrous AlCl_3 ?



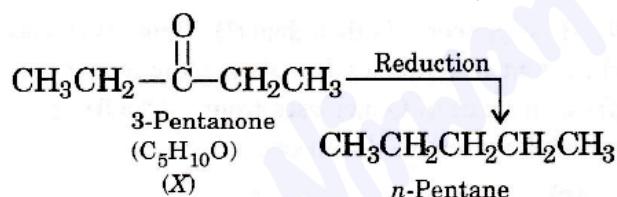
4) (a) An organic compound 'A' having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ gives negative Tollens' test, forms n-pentane on Clemmensen reduction but doesn't give iodoform test. Identify 'A' and give all the reactions involved.

(b) Carry out the following conversions:

(i) Propanoic acid to 2-Bromopropanoic acid

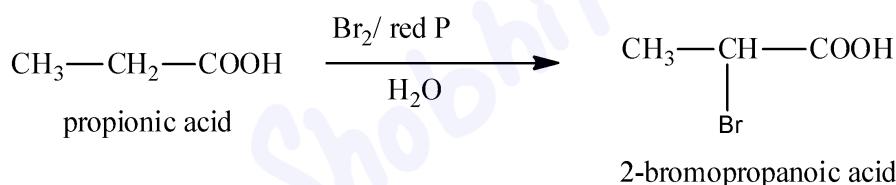
(ii) Benzoyl chloride to benzaldehyde

(c) How will you distinguish between benzaldehyde and acetaldehyde?

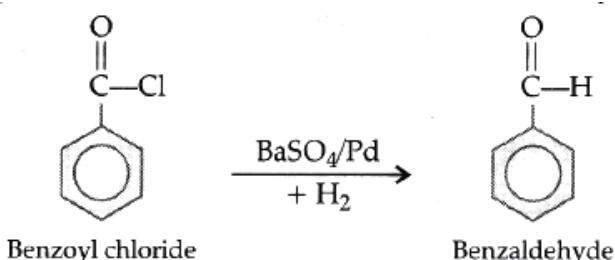


Ans. a) 3-pantanone,

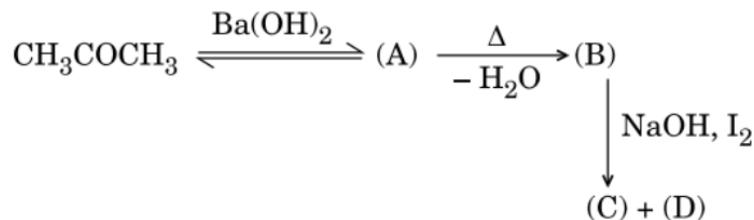
b) i)



ii)



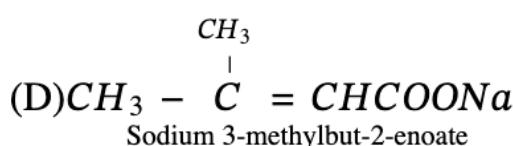
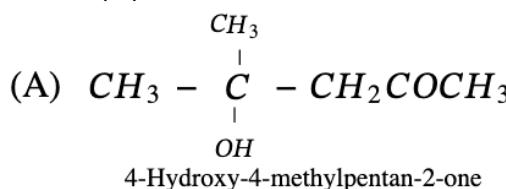
5) (a) Complete the following sequence of reactions:



(i) Identify (A) to (D).

- (ii) Give the IUPAC name of (A).
 (b) How can you distinguish between:
 (i) Ethanol and Propanone, and
 (ii) Benzoic acid and Phenol?

Ans. a) i)



ii) 4-Hydroxy-4-methylpentan-2-one

6) Assertion (A): Reactivity of ketones is more than aldehydes.

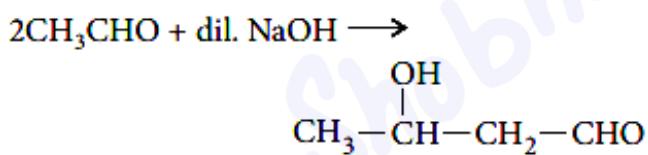
Reason (R) : The carbonyl carbon of ketones is less electrophilic as compared to aldehydes.

Ans. Both Assertion and Reason are correct and Reason is the correct explanation for Assertion

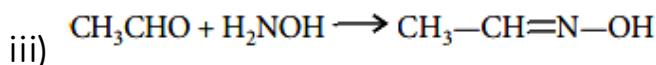
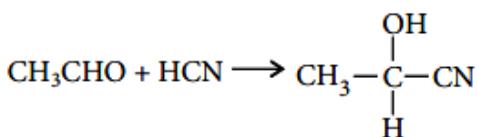
7) Write the products formed when $(CH_3)_3C\text{-CHO}$ reacts with the following reagents:

- (i) CH_3COCH_3 in the presence of dilute NaOH
- (ii) HCN
- (iii) Conc. NaOH

Ans. i)



ii)



8) Assertion (A) : Benzoic acid does not undergo Friedel-Crafts reaction.
 Reason (R) : The carboxyl group is activating and undergo electrophilic substitution reaction.

Ans. A is correct but R is wrong

9) (a) An organic compound (A) having molecular formula C_4H_8O gives orange red precipitate with 2, 4-DNP reagent. It does not reduce Tollens' reagent but gives yellow precipitate of iodoform on heating with NaOH

and I_2 . Compound (A) on reduction with $NaBH_4$ gives compound (B) which undergoes dehydration reaction on heating with conc. H_2SO_4 to form compound (C). Compound (C) on Ozonolysis gives two molecules of ethanal.

I) Identify (A), (B) and (C) and write their structures.

II) Write the reactions of compound (A) with

(i) $NaOH/I_2$ and

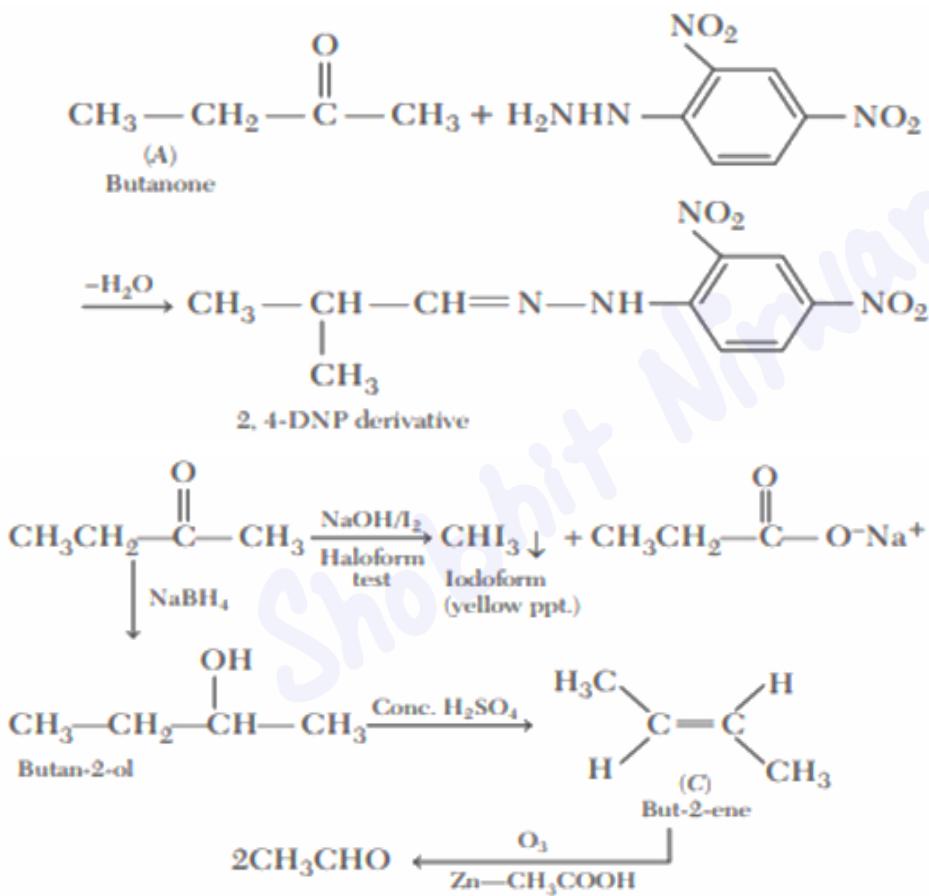
(ii) $NaBH_4$

(b) Give reasons:

(i) Oxidation of propanal is easier than propanone.

(ii) α -hydrogen of aldehydes and ketones is acidic in nature.

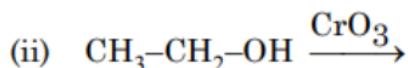
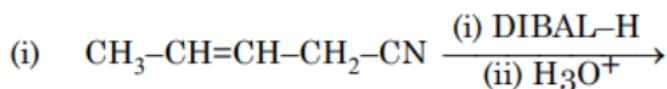
Ans. a)



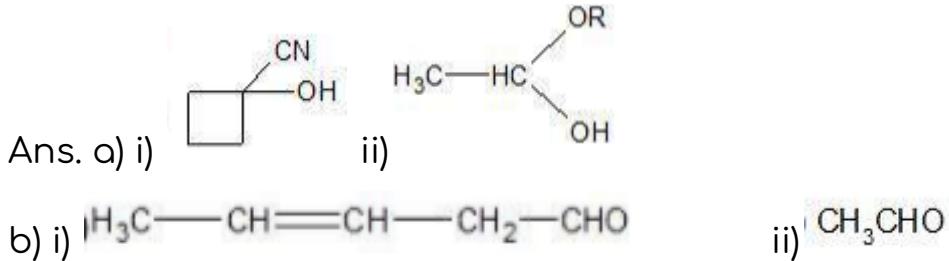
10) (a) Draw structures of the following derivatives:

(i) Cyanohydrin of cyclobutanone (ii) Hemiacetal of ethanal

(b) Write the major product(s) in the following:



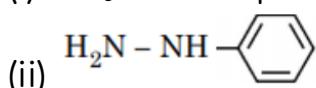
(c) How can you distinguish between propanal and propanone?



11) Assertion (A): Oxidation of ketones is easier than aldehydes.
 Reason (R): C-C bond of ketones is stronger than C-H bond of aldehydes.
 Ans. Assertion is incorrect but Reason is correct

12) (a) Write the products formed when benzaldehyde reacts with the following reagents

(i) CH_3CHO in presence of dilute NaOH



(iii) Conc. NaOH

(b) Distinguish between following:

(i) $\text{CH}_3 - \text{CH} = \text{CH}-\text{CO CH}_3$ and $\text{CH}_3 \text{CH}_2 \text{CO CH} = \text{CH}_2$

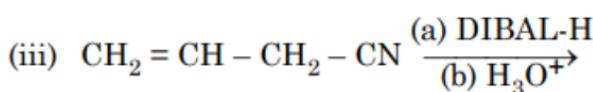
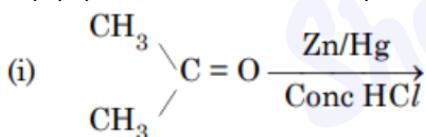
(ii) Benzaldehyde and Benzoic acid.

Ans. a) i) 3-hydroxy-3-phenylpropanal

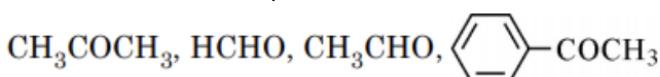
ii) Phenyl hydrazone of benzaldehyde

iii) Sodium benzoate and benzyl alcohol

13) (a) Write the final products in the following:



(b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction:



(c) Draw the structure of 2, 4-DNP derivative of acetaldehyde

Ans. a)

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

(ii) C_6H_6

(ii) $\text{CH}_2=\text{CH}-\text{CH}_2\text{CHO}$



c)



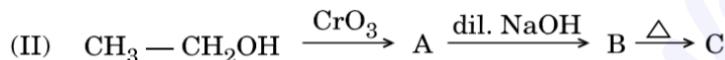
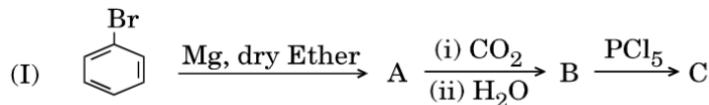
2021

1) Assertion (A) : Benzoic acid does not give Friedel-Crafts reaction.

Reason(R) : The carboxyl group is deactivating and gets bonded to Lewis acid AlCl_3

Ans. Both assertion and reason are correct statements and reason is correct explanation of assertion

2) (a) (i) Identify A, B and C in the following reactions :

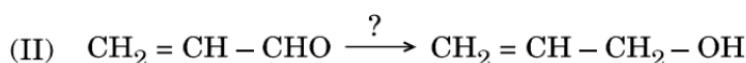
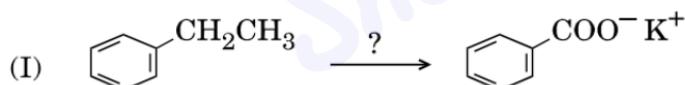


(ii) By what tests will you distinguish between :

- (I) Ethanol and Benzaldehyde
- (II) Acetone and Acetic acid

OR

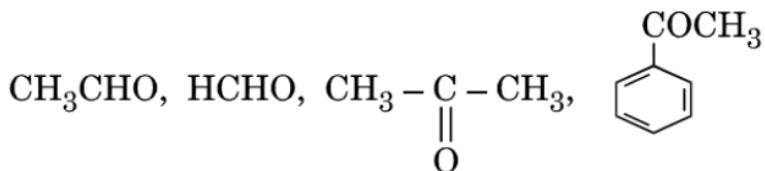
(b) (i) Name the reagents used in the following reactions :



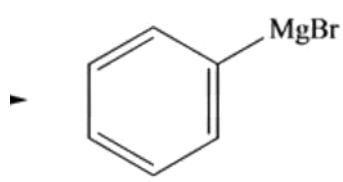
(ii) Write the structure of oxime of propanal.

(iii) Why does carboxylic acid not give reactions of aldehydes and ketones ?

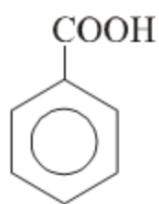
(iv) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction :



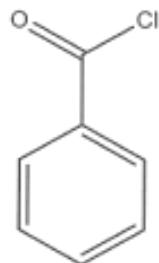
Ans. a) i)



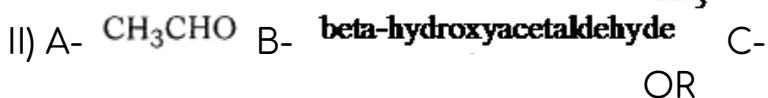
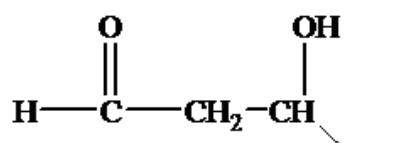
I) A - Phenylmagnesium bromide
(Grignard reagent)



B- Benzoic acid



C- Benzoyl chloride

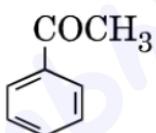
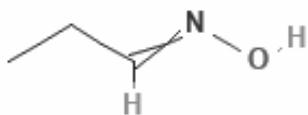


b) i)

I) Alkaline potassium permanganate ($\text{KMnO}_4\text{-KOH}$)

II) NaBH_4

ii)



ORGANIC COMPOUNDS CONTAINING NITROGEN (AMINES)

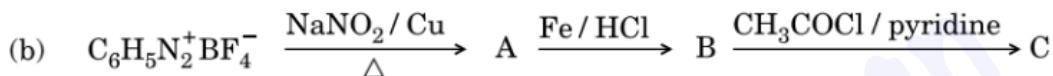
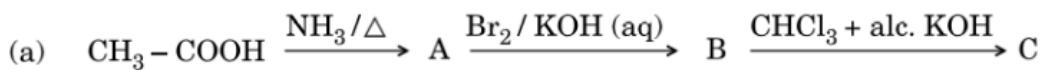
2016

1) Give reasons for the following

- i) Aniline does not undergo Friedel-Crafts reaction
- ii) $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.
- iii) Primary amines have higher boiling point than tertiary amines

2017

1) Write the structures of compounds A, B and C in the following reactions:



Ans. (a) A: CH_3COO^- B: $\text{BrCH}_2\text{COO}^-$ C: $\text{CCl}_3\text{CHCOO}^-$

(a) A: $\text{C}_6\text{H}_5\text{N}_2^+$ B: $\text{C}_6\text{H}_5\text{Cl}$ C: 2 – chloroacetophenone and 4 – chloroacetophenone

2018

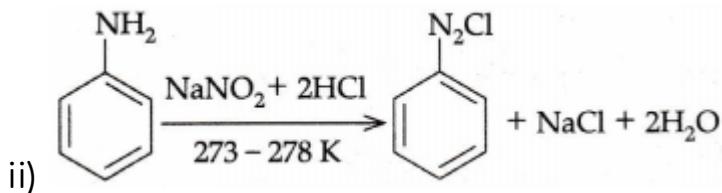
1) (a) Write the reactions involved in the following:

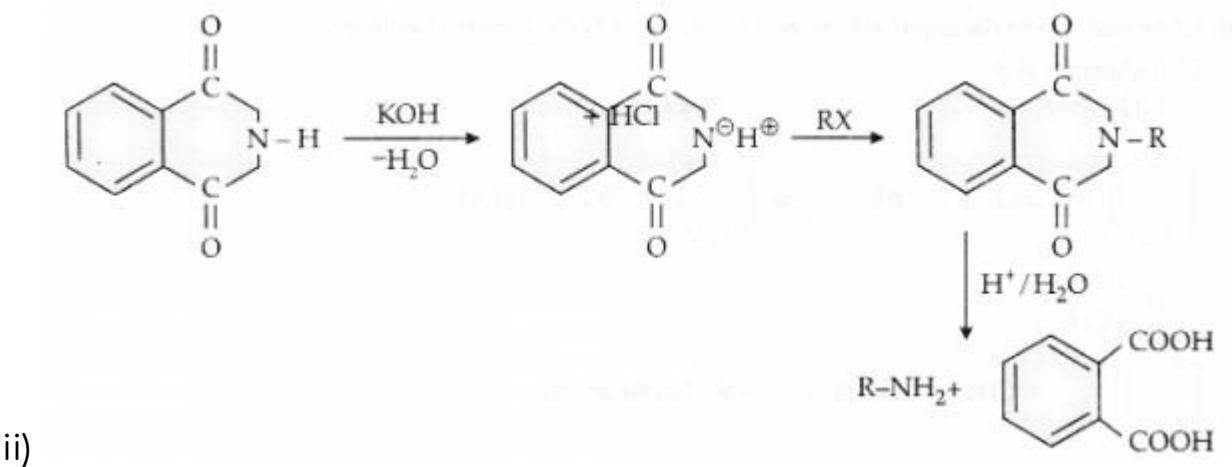
- (i) Hofmann bromamide degradation reaction
- (ii) Diazotisation
- (iii) Gabriel phthalimide synthesis

(b) Give reasons :

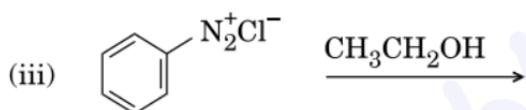
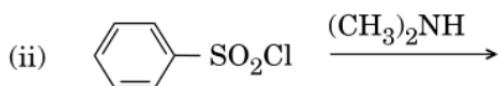
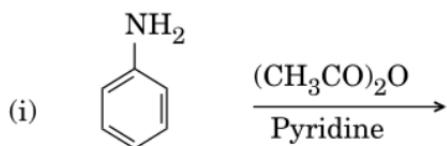
- (i) $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.
- (ii) Aromatic diazonium salts are more stable than aliphatic diazonium salts.

Ans. a) i)





2) (a) Write the structures of the main products of the following reactions:

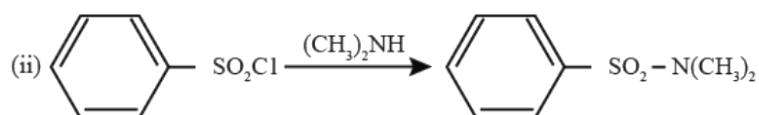
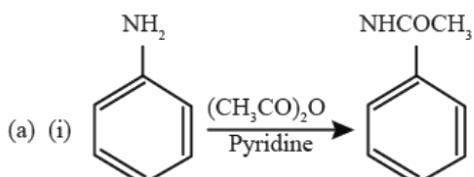


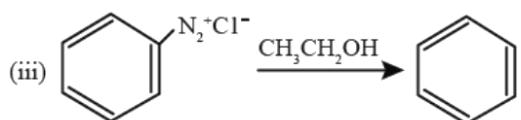
(b) Give a simple chemical test to distinguish between Aniline and N,N-dimethylaniline.

(c) Arrange the following in the increasing order of their ρK_b values :



Ans.





N, N-dimethylaniline + CHCl_3 + KOH \rightarrow No reaction

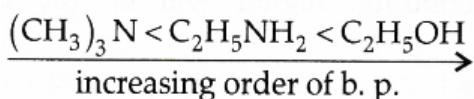
(c) $\text{C}_2\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{NHCH}_3 < \text{C}_6\text{H}_5\text{NH}_2$

2019

1) Arrange the following in increasing order of boiling points :

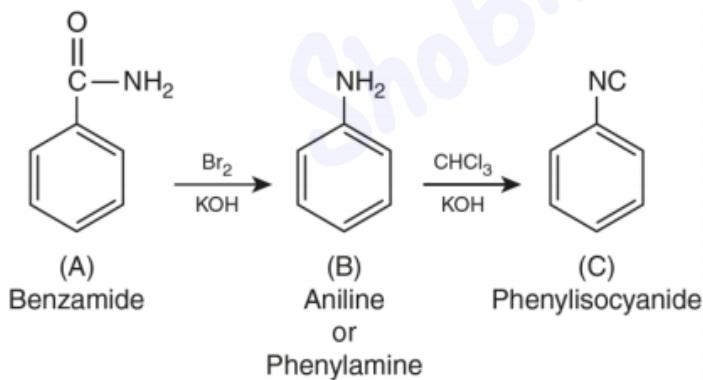
$(\text{CH}_3)_3\text{N}$, $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_2\text{H}_5\text{NH}_2$

Ans.



2) An aromatic compound 'A' on heating with Br_2 and KOH forms a compound 'B' of molecular formula $\text{C}_6\text{H}_7\text{N}$ which on reacting with CHCl_3 and alcoholic KOH produces a foul smelling compound 'C'. Write the structures and IUPAC names of compounds A, B and C.

Ans.

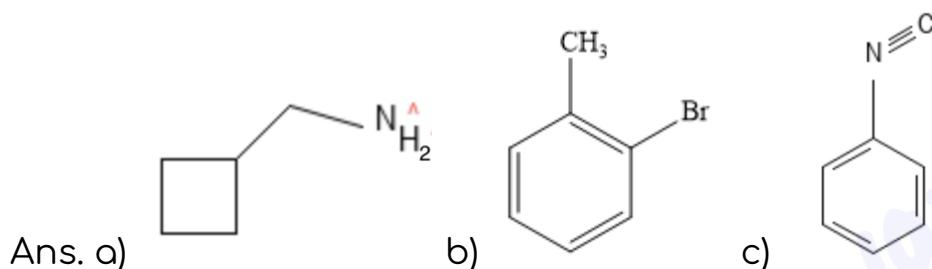
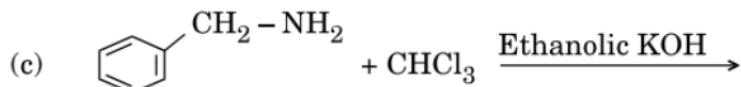
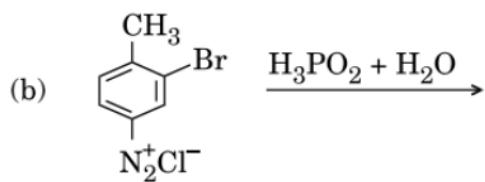
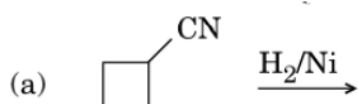


3) Arrange the following in decreasing order of basic character :

$\text{C}_6\text{H}_5\text{NH}_2$, $(\text{CH}_3)_3\text{N}$, $\text{C}_2\text{H}_5\text{NH}_2$

Ans. $(\text{CH}_3)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{NH}_2$

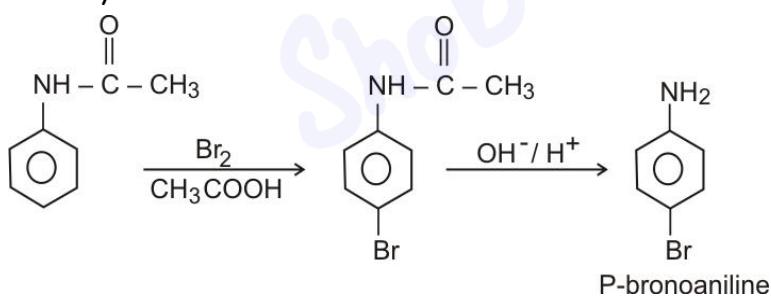
4) Complete the following reactions :



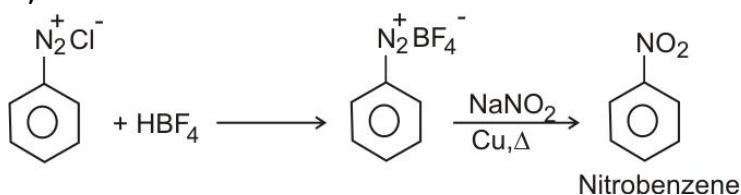
5) How do you convert the following :

- (a) N-phenylethanamide to p-bromoaniline
- (b) Benzene diazonium chloride to nitrobenzene
- (c) Benzoic acid to aniline

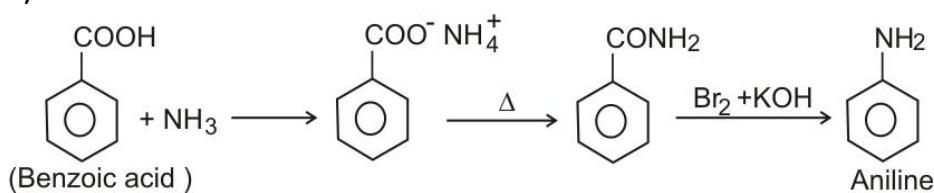
Ans. a)



b)



c)

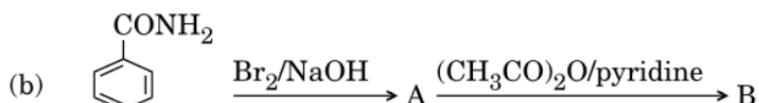
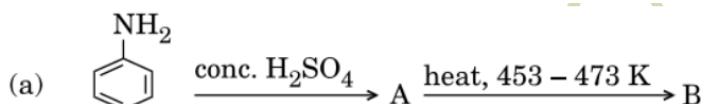


6) Account for the following :

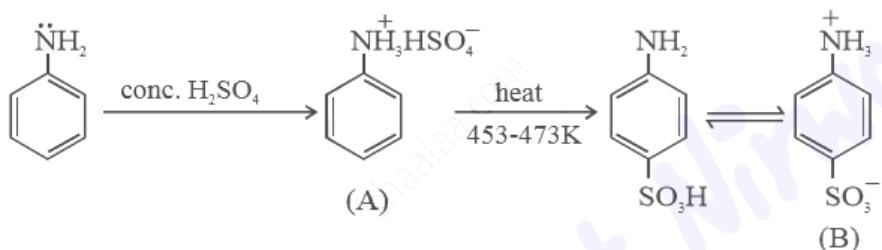
(a) Gabriel phthalimide synthesis is not preferred for preparing aromatic primary amines.

(b) On reaction with benzene sulphonyl chloride, primary amine yields product soluble in alkali whereas secondary amine yields product insoluble in alkali.

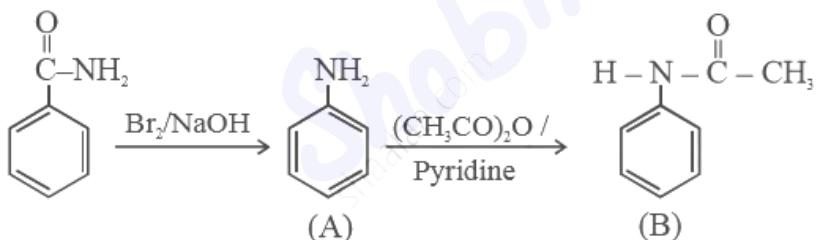
7) Write structures of compounds A and B in each of the following reactions :



Ans. a)



b)



8) Write the reaction involved in the Hoffmann bromamide degradation reaction.



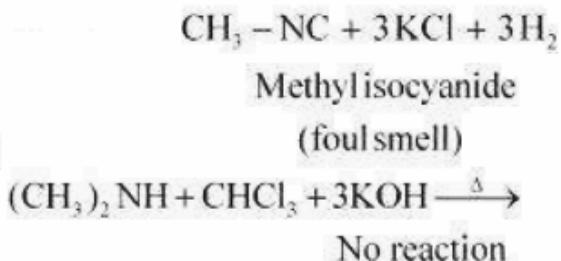
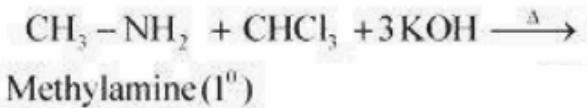
OR

Propanamine and N,N-dimethylmethanamine contain the same number of carbon atoms, even though Propanamine has higher boiling point than N,N-dimethylmethanamine. Why?

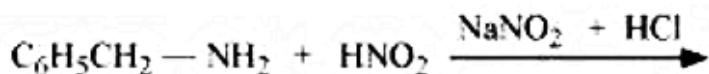
9) (a) Give one chemical test to distinguish between the compounds of the following pairs:

(i) CH_3NH_2 and $(\text{CH}_3)_2\text{NH}$

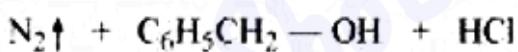
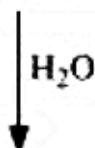
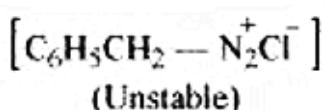
- (ii) Aniline and Ethanamine
 (b) Why aniline does not undergo Friedel-Crafts reaction ?
 Ans. a) i)



ii)



Benzylamine



Benzyl alcohol

aniline reacts with HNO_2 at a low temperature to form stable diazonium salt

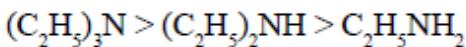
10) Account for the following, supporting your answer with diagrams or equations wherever possible:

- (a) Diazonium salts of aromatic amines are more stable than those of aliphatic amines.
 (b) Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide.

11) Arrange the following in decreasing order of pK giving reason :

- (a) Aniline, ρ -nitroaniline and ρ -toluidine
 (b) $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $(\text{C}_2\text{H}_5)_3\text{N}$ in gaseous state

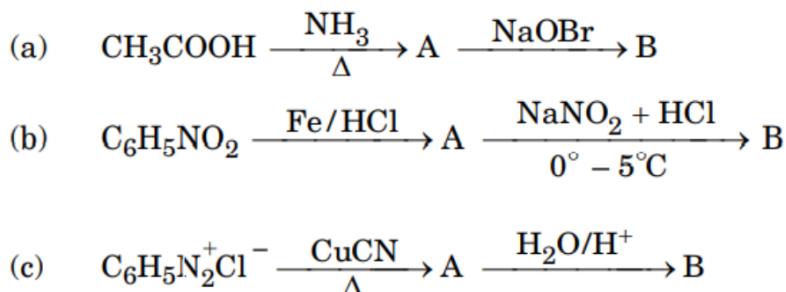
Ans. a) ρ -toluidine > aniline > ρ -nitroaniline
 b)



2020

- 1) Out of the following, the strongest base in aqueous solution is
 (A) Methylamine (B) Dimethylamine (C) Trimethylamine (D) Aniline
 Ans. (B)

2) Give the structures of A and B in the following sequence of reactions :



- Ans. a) (A) CH_3CONH_2 (B) CH_3NH_2
 (b) (A) $\text{C}_6\text{H}_5\text{NH}_2$ (B) $\text{C}_6\text{H}_5\text{N}_2\text{Cl}$
 (c) (A) $\text{C}_6\text{H}_5\text{CN}$ (B) $\text{C}_6\text{H}_5\text{COOH}$

- 3) (a) How will you distinguish between the following pairs of compounds :
 (i) Aniline and Ethanamine
 (ii) Aniline and N-methylaniline
 (b) Arrange the following compounds in decreasing order of their boiling points

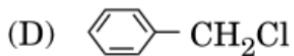
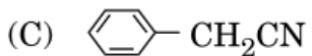
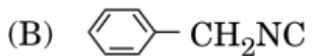
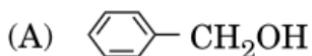
Butanol, Butanamine, Butane

Ans. b) Butanol > Butanmine > Butane

4) Account for the following:

- (a) Aniline is a weaker base compared to ethanamine.
- (b) Aniline does not undergo Friedel-Crafts reaction.
- (c) Only aliphatic primary amines can be prepared by Gabriel Phthalimide synthesis.

- 5)  CH_2-NH_2 , on heating with CHCl_3 and alcoholic KOH gives foul smell of



Ans. (B)

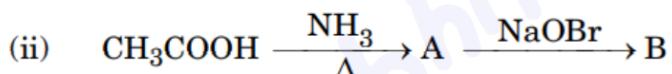
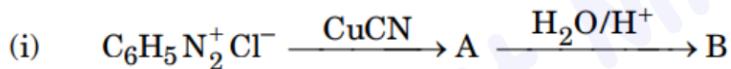
6) (a) Give reasons:

- (i) Although NH_2 group is o/p directing in electrophilic substitution reactions, yet aniline, on nitration gives good yield of m-nitroaniline.
(ii) $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.
(iii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines.

(b) Distinguish between the following:

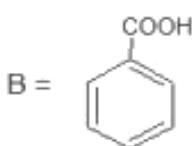
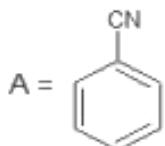
- (i) $\text{CH}_3\text{CH}_2\text{NH}_2$ and $(\text{CH}_3\text{CH}_2)_2\text{NH}$
(ii) Aniline and CH_3NH_2

7) (a) Write the structures of A and B in the following reactions:

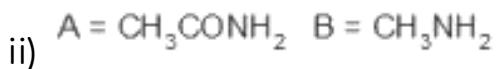


(b) Write the chemical reaction of methyl amine with benzoyl chloride and write the IUPAC name of the product obtained.

(c) Arrange the following in the increasing order of their pK_b values:



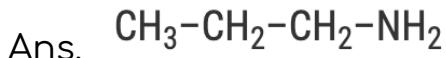
Ans. a) i)



b) N-Methylbenzamide

c) $(\text{C}_2\text{H}_5)_2\text{NH} < \text{C}_2\text{H}_5\text{NH}_2 < \text{NH}_3 < \text{C}_6\text{H}_5\text{NH}_2$

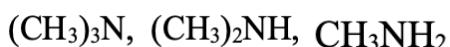
8) Write an isomer of $\text{C}_3\text{H}_9\text{N}$ which gives foul smell of isocyanide when treated with chloroform and ethanolic NaOH.



9) Arrange the following compounds as directed:

(i) In increasing order of solubility in water: $(\text{CH}_3)_2\text{NH}$, CH_3NH_2 , $\text{C}_6\text{H}_5\text{NH}_2$

(ii) In decreasing order of basic strength in aqueous solution:



(iii) In increasing order of boiling point: $(\text{C}_2\text{H}_5)_2\text{NH}$, $(\text{C}_2\text{H}_5)_3\text{N}$, $\text{C}_2\text{H}_5\text{NH}_2$

Ans.



10) CH_3CONH_2 on reaction with NaOH and Br_2 in alcoholic medium gives

- (a) $\text{CH}_3\text{CH}_2\text{NH}_2$ (b) $\text{CH}_3\text{CH}_2\text{Br}$ (c) CH_3NH_2 (d) CH_3COONa

Ans. (C)

11) Give reasons:

- (i) Aniline does not undergo Friedel-Crafts reaction.
- (ii) Aromatic primary amines cannot be prepared by Gabriel's phthalimide synthesis.
- (iii) Aliphatic amines are stronger bases than ammonia

2021

1) Read the passage given below and answer the following questions :

Amines can be considered as derivatives of ammonia and are usually formed from nitriles, nitro, halides, amides, etc. They show hydrogen bonding which influences their physical properties. In aromatic amines, electron releasing and withdrawing groups respectively increase and decrease their basic character.

Hinsberg test is used for the identification and distinction between primary, secondary and tertiary amines.

The following questions are multiple choice questions :

(i) Ethyl amine can be prepared by the action of LiAlH_4 on

- (A) CH_3NO_2
- (B) $\text{CH}_3 - \text{CN}$
- (C) $\text{CH}_3 - \text{NC}$
- (D) $\text{CH}_3 - \text{CH}_2 - \text{CONH}_2$

Ans. (D)

(ii) Which of the following reagents is used for the Hinsberg test of amines ?

- (A) C_6H_5COCl
- (B) CH_3COCl
- (C) $C_6H_5 - SO_3H$
- (D) $C_6H_5 - SO_2Cl$

Ans. (B)

(iii) Out of the following, the strongest base in aqueous solution is :

- (A) $(CH_3)_2NH$
- (B) $(CH_3)_3N$
- (C) $CH_3 - NH_2$
- (D) $C_6H_5 - NH_2$

Ans. (A)

(iv) The reaction of ammonia with a large excess of CH_3Cl will give mainly :

- (A) C_2H_6
- (B) $(CH_3)_2NH$
- (C) $(CH_3)_4N^+Cl^-$
- (D) $CH_3 - NH_2$

Ans. (D)

OR

Among the following amines, which one is expected to have the lowest boiling point ?

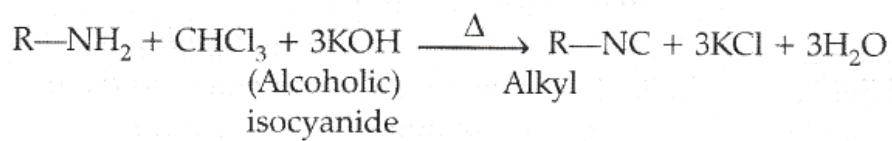
- (A) $C_2H_5 - NH_2$
- (B) $(C_2H_5)_3N$
- (C) $(C_2H_5)_2NH$
- (D) $CH_3 - NH_2$

Ans. (B)

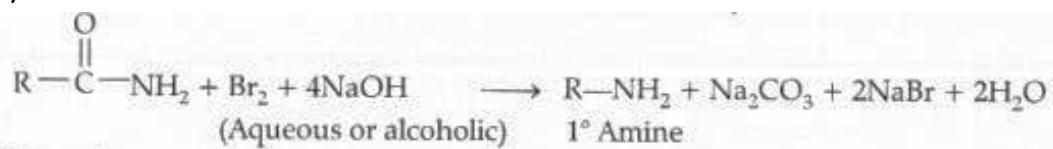
2) Write the equations involved in the following reactions :

- (i) Carbylamine reaction
- (ii) Hoffmann bromamide degradation reaction

Ans. i)



ii)



BIOMOLECULES

2007

- 1) What are reducing sugars?
- 2) What is meant by denaturation of a protein?
- 3) Define enzyme

2008

- 1) Write two main functions of carbohydrate in plants
- 2) What happens when glucose is treated with
 - (i) HI
 - (ii) Bromine water
 - (iii) HNO₃
- 3) How are vitamins classified? Mention the chief source of Vitamin A and C
- 4) Describe by giving example
 - (i) Glycosidic linkage
 - (ii) Peptide linkage
 - (iii) Primary structure of protein
 - (iv) Denaturation of protein.

2009

- 1) Name the four bases in DNA. Which one is not present in RNA?

Ans. adenine (A), guanine (G), cytosine (C) and thymine (T).

Thymine (T), is not present in RNA.

- 2) Name two fat soluble vitamins, their sources and diseases caused due to their deficiency.

Ans. (i) Vitamin A. Fish oil, carrot, milk, egg yolk. Night blindness and Xerophthalmia.

(ii) Vitamin D. Sunlight, fish, egg yolk. Rickets and osteomalacia.

2010

- 1) What are reducing sugars?

2) Amino acids may be acidic, alkaline or neutral. How does this happen?

- 3) What are essential and non-essential amino acids? Name one of each type.

Ans. Essential Amino Acids : valine.

Nonessential amino acids : glycine.

- 4) What is the product of hydrolysis of sucrose?

Ans. glucose and fructose

5) Differentiate between fibrous and globular proteins.

6) What is meant by denaturation of a protein?

7) What are mono-saccharides?

2011

1) Explain

(i) Peptide linkage

(ii) Pyranose structure of glucose

2) Write the main structural difference between DNA and RNA

3) Of the four bases, name those which are common to both DNA and RNA.

Ans. adenine (A), guanine (G) and cytosine (C).

4) Write such reactions and facts about glucose that cannot be explained by its open chain structure.

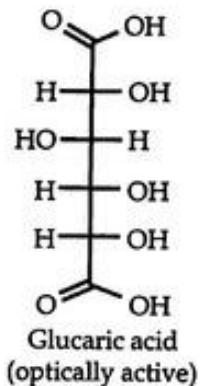
2012

1) What is essentially the difference between α -glucose and β -glucose?

2) What is meant by pyranose structure of glucose?

3) Write the structure of product obtained when glucose is oxidised by nitric acid.

Ans.



2013

1) Write the name of linkage joining two amino acids.

Ans. peptide bond (amide bond)

2) Shanti, a domestic helper of Mrs. Anuradha, fainted while mopping the floor. Mrs. Anuradha immediately took her to the nearby hospital where she was diagnosed to be severely 'anaemic.' The doctor prescribed an iron rich diet and multivitamins supplement to her. Mrs. Anuradha supported her financially to get the medicines. After a month, Shanti was diagnosed to be normal.

After reading the above passage, answer the following questions

- (i) What values are displayed by Mrs. Anuradha ?
- (ii) Name the vitamin whose deficiency causes 'pernicious anaemia'.
- (iii) Give an example of water soluble vitamin.

Ans. ii) vitamin B₁₂

iii) thiamin (vitamin B₁)

3) What is the product of hydrolysis of sucrose?

2014

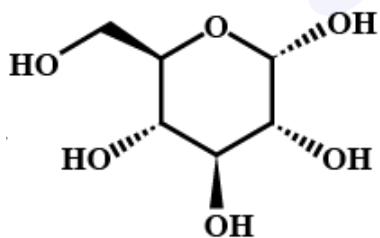
1) What are the products of hydrolysis of sucrose?

2) Define the following terms as related to proteins:

- (i) Peptide linkage
- (ii) Primary structure
- (iii) Denaturation

3) What are the products of hydrolysis of maltose?

Ans.



α -D-glucopyranose

4) Define the following terms:

- (i) Glycosidic linkage
- (ii) Invert sugar
- (iii) Oligosaccharides

2015

1) Which one of the following is an oligosaccharide: starch, maltose, fructose, glucose?

Ans. maltose

2) Write one difference between DNA and RNA?

3) Write the name of the disease caused by the deficiency of Vitamin B1.

Ans. Beriberi

2016

1) Write the name of monosaccharides which are obtained after the hydrolysis of lactose.

Ans. D-Glucose and D-Galactose

2) What type of bonding is responsible for the stability of α -Helix.

Ans. Hydrogen bonds

3) Write the difference between Nucleotide and Nucleoside.

2017

After watching a programme on TV about the presence of carcinogens (cancer causing agents) Potassium bromate and Potassium iodate in bread and other bakery products, Rupali a class XII student decided to make others aware about the adverse effects of these carcinogens in food. She consulted the school principal and requested him to instruct the canteen contractor to stop selling sandwiches, pizzas, burgers and other bakery products to the students. The principal took an immediate action and instructed to the canteen contractor to replace the bakery products with some protein and vitamin rich food like fruits, salads, sprouts, etc. The decision was welcome by the parents and the students.

After reading the above passage, answer the following questions:

(i) What are the values (at least two) displayed by Rupali?

(ii) Which polysaccharide component of carbohydrate is commonly present in bread?

(iii) Write the two types of secondary structures of protein

(iv) Give two examples of water soluble vitamins.

Ans. (ii) Starch.

(iii) α - helix and β - pleated sheets.

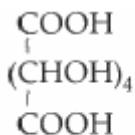
(iv) Vitamin - B and Vitamin - C.

2018

1) Define the following with an example of each:

a) Polysaccharides b) Denatured protein c) Essential amino acids

- 2) a) Write the product when D-glucose reacts with conc. HNO_3 .
b) Amino acids show amphoteric behaviour. Why?
c) Write one difference between α -helix and β -pleated structures proteins.



Ans. a) D-saccharic acid

2019

1) What is the basic structural difference between glucose and fructose?

OR

Write the products obtained after hydrolysis of lactose.

Ans. β -D-Glucose and β -D-Galactose

2) Differentiate between the following:

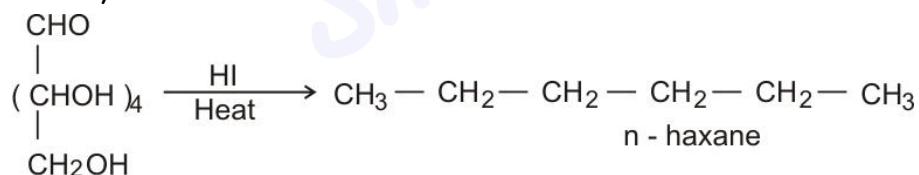
- i) Amylose and Amylopectin
ii) Peptide linkage and Glycosidic linkage.
iii) Fibrous proteins and Globular proteins

OR

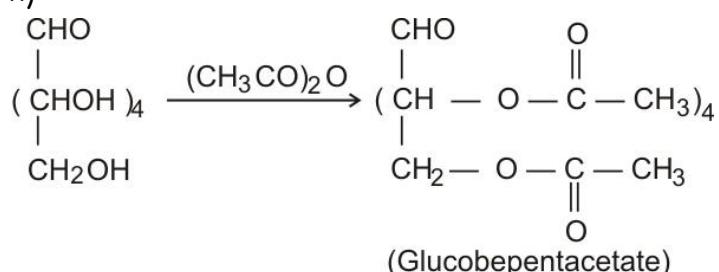
Write chemical reactions to show that open structure of D glucose contains the following:

- i) Straight chain ii) Five alcohol groups iii) Aldehyde as carbonyl group

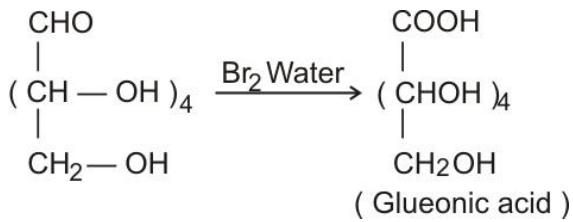
Ans. i)



ii)



iii)



3) What is the basic structural difference between starch and cellulose?
OR

Write the products obtained after hydrolysis of DNA.

Ans. β -D-2-deoxyribose, phosphoric acid and adenine

- 4) (a) What are the products of hydrolysis of maltose?
 (b) What type of bonding provides stability to α -helix structure of protein?
 (c) Name the vitamin whose deficiency causes pernicious anaemia.

Ans. c) Vitamin B12

OR

Define the following terms:

(a) Invert sugar (b) Native protein (c) Nucleotide.

- 5) What is the difference between a glycosidic linkage and a peptide linkage ?

OR

What is the difference between Nucleotide and Nucleoside ?

- 6) Define the following terms with a suitable example of each :
 a) Anomers (b) Essential amino acids (c) Denaturation of protein

- 7) (a) Give any one property of glucose that cannot be explained by the open chain structure.

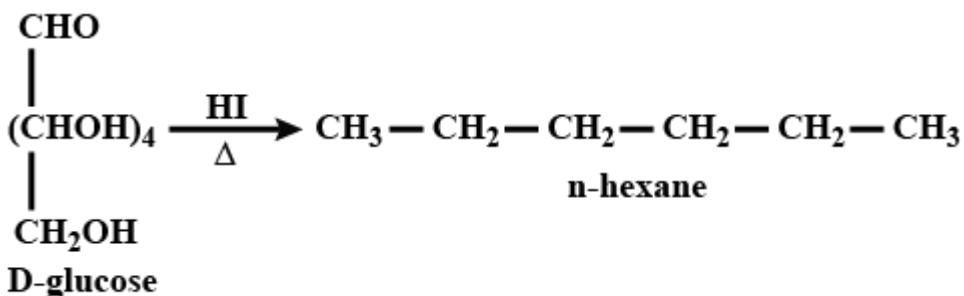
(b) Compare amylase with amylopectin in terms of constituting structure.

(c) Why do amino acids show amphoteric behaviour ?

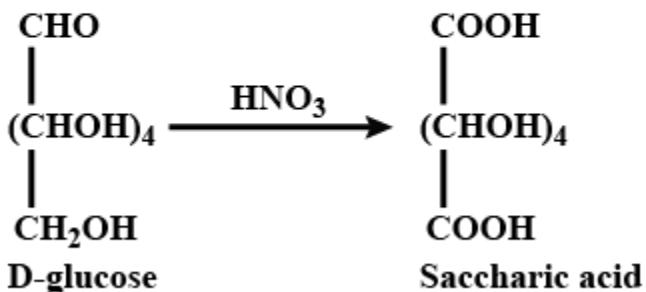
- 8) What happens when D-glucose is treated with the following ? Give equations to support your answer.

(a) HI (b) HNO_3

Ans. a)



b)



(OR)

Give any two points of difference between globular and fibrous Proteins.

9) Write two differences between DNA and RNA

2020

1) Assertion (A) : Sucrose is a non-reducing sugar.

Reason (R) : Sucrose has glycosidic linkage.

Ans. Both A and R are true and the R is the correct explanation of the A.

2) Give the possible explanation for the following:

(a) Glucose doesn't give 2,4-DNP test.

(b) The two strands in DNA are not identical but are complementary.

(c) Starch and cellulose both contain glucose unit as monomer, yet they are structurally different.

3) Read the given passage and answer the questions number 1 to 5 that follow:

Organic compounds containing amine as functional group are present in a vivid variety of compounds, namely amino acids, hormones, neurotransmitters, DNA, alkaloids, dyes, etc. Drugs including nicotine, morphine, codeine and heroin, etc. which have physiological effects on humans also contain amino group in one form or another. Amines are basic because of the presence of lone pair of electrons on nitrogen. Addition of nitrogen into an organic framework leads to the formation of

two families of molecules, namely amines and amides. As chemistry students, we must appreciate the versatility of nitrogen.

- i. What are amino acids?
- ii. Why are amino acids amphoteric?
- iii. Give one point of difference between acidic and basic amino acid.
- iv. What are essential amino acids?
- v. Name the linkage formed when carboxyl end of one amino acid condenses with amino end of other amino acid.

Ans. v) Peptide Bond

4) Assertion (A) Albumin is a globular protein.

Reason (R): Polypeptide chain coils around to give a straight chain.

Ans. (A) is correct, but (R) is incorrect statement.

5) Define the following terms:

i) Oligosaccharides

ii) Invert sugar

6) Write the name of component of starch which is water soluble.

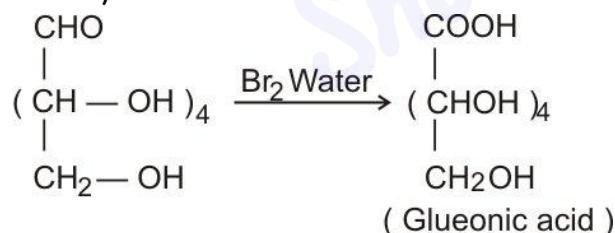
Ans. Amylose

7) Write the reactions showing the presence of following in the open structure of glucose:

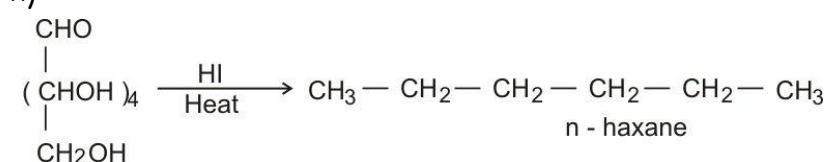
(i) a carbonyl group

(ii) Straight chain with six carbon atoms

Ans. i)



ii)



8) Amino acids are

- a) acidic b) basic c) amphoteric d) neutral

Ans.(c)

9) Differentiate between following:

- (i) Amylose and Amylopectin

- (ii) Globular protein and Fibrous protein
- (iii) Nucleotide and Nucleoside

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