

Aldehydes, Ketones & Carboxylic acids

Que 1: Arrange the following carboxylic acids in the increasing order of acidic strength. Justify your answer.

Marks : (2)

CF_3COOH , CH_3COOH , $\text{C}_6\text{H}_5\text{COOH}$

Ans: $\text{CH}_3\text{COOH} < \text{C}_6\text{H}_5\text{COOH} < \text{CF}_3\text{COOH}$

Electron withdrawing group stabilises the carboxylate anion and strengthening the acid

Que 2: The IUPAC name of Is butyraldehyde is -----

Marks : (1)

Ans: 2-Methylpropanal

Que 3: An α -hydrogen is a hydrogen attached to carbon atom adjacent to carbonyl group in a carbonyl compound.

a) Name a reaction which distinguishes the carbonyl compound having α -hydrogen from those without α hydrogen atom.

b) Explain such a reaction with chemical equation.

Marks : (3)

Ans: a) Aldol condensation or Cannizzaro's reaction

b) Aldol condensation of aldehyde or ketone with α -H using dilute alkali

or

Cannizzaro's reaction of aldehyde without α -H using conc. – alkali.

Que 4: Account for the following statements.

Marks : (3)

a) CH_3COOH is more acidic than phenol.

b) Carboxylic acid do not undergo Friedel crafts reaction.

c) Carboxylic acids are higher boiling liquid than aldehydes of comparable molecular mass.

Ans: Acetate ion is more stabilized than phenoxide ion by resonance

Carboxyl group is deactivating and the catalyst AlCl_3 get bonded to carboxyl group.

Association of carboxylic acid molecules through intermolecular hydrogen bonding.

Que 5: Complete the table.

Substrate	Reagent	Name of reaction
Benzoyl chloride	$\text{H}_2/\text{Pd} - \text{BaSO}_4$	
$\text{CH}_3\text{CH}_2\text{COOH}$		Hell Volhard Zelinsky
CH_3COONa		Kolbe's electrolysis



KOH/Ethylene glycol

Ans:

Substrate	Reagent	Name of reaction
Benzoyl chloride	$\text{H}_2/\text{Pd} - \text{BaSO}_4$	Rosenmund reduction
$\text{CH}_3\text{CH}_2\text{COOH}$	Red P/ Cl_2	Hell Volhard Zelinsky
CH_3COONa	Electrolysis of aqueous solution	Kolbe's electrolysis
CH_3COCH_3	Hydrazine + KOH/Ethylene glycol	Wolf Kishner

Que 6: Arrange the following in the increasing order of their acidic strength.

CH_3COOH , FCH_2COOH , $\text{ClCH}_2\text{CH}_2\text{COOH}$, ClCH_2COOH Marks : (1)

Ans: $\text{CH}_3\text{COOH} < \text{ClCH}_2\text{CH}_2\text{COOH} < \text{ClCH}_2\text{COOH} < \text{FCH}_2\text{COOH}$

Que 7: Carboxylic acids are more acidic than phenols. Why? Marks : (2)

Ans: Carboxylate anion is more stable than phenoxide ions because of resonance and the negative charge is more delocalised on the more electronegative oxygen atoms.

Que 8: Carboxylic acids have higher boiling point than alcohols of comparable molecular mass. Give reason. Marks : (2)

Ans: Intermolecular hydrogen bonding leading to dimer formation in acids.

Que 9: convert the following Marks : (3)

CH_3CN to CH_3COOH

Ans: $\text{CH}_3\text{CN} + \text{H}^+/\text{H}_2\text{O} \rightarrow \text{CH}_3\text{COOH}$

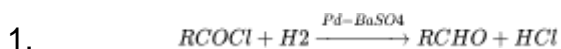
Que 10: Suggest any two reagents that can convert CH_3COOH to CH_3COCl .
Marks : (2)

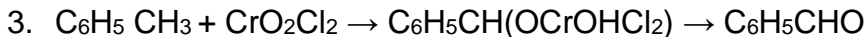
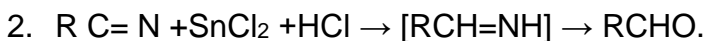
Ans: PCl_5 , SOCl_2

Que 11: Explain the following reactions Marks : (3)

1. Rosenmunds reduction
2. Stephen reaction
3. Etard reaction

Ans:





Que 12: Aldehydes are more reactive than ketones towards nucleophilic addition reaction. Why? **Marks : (2)**

Ans: i) Steric effect :- In ketones, there are two bulky alkyl or aryl groups which hinder the approach of nucleophile

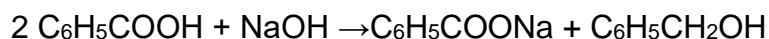
ii) Electronic effect :- In ketones, there are two electron releasing alkyl or aryl groups which reduces the electrophilicity of carbonyl carbon through inductive or resonance effects

Que 13: Name the best oxidising agent that can convert unsaturated primary alcohol to unsaturated aldehyde. **Marks : (1)**

Ans: PCC

Que 14: Benzaldehyde and acetaldehyde react with NaOH under different conditions give different products. Explain the reactions? **Marks : (3)**

Ans: Benzaldehyde, having no α hydrogen, undergoes Cannizzaro's reaction with conc. NaOH to give salt of carboxylic acid and an alcohol



Acetaldehyde having α H atom undergoes aldol condensation in presence of dil. NaOH to form an aldol which on heating eliminates water to form unsaturated aldehyde



Que 15: Distinguish the following pairs of compounds chemical tests

i) Acetophenone and benzophenone

ii) Ethanal and propanone

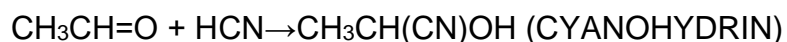
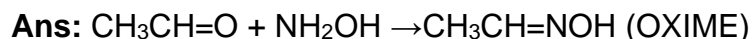
Marks : (3)

Ans: i) Iodoform test: Acetophenone on warming with iodine and NaOH gives yellow precipitate of iodoform but benzophenone does not answer the test

ii) Tollen's test: Ethanal on heating with ammoniacal silver nitrate solution gives silver mirror but propanone does not answer the test.

Que 16: Write down the reaction and name the product when acetaldehyde reacts with the following? **Marks : (3)**

i) hydroxylamine ii) Hydrogencyanide



Que 17: Arrange the following compounds in the increasing order of boiling point?

Ethanol, Ethanal, Ethanoic acid, Ethane

Marks : (2)

Ans: Ethane < ethanal < ethanol < ethanoic acid

Que 18: Identify the reaction and reagents for converting benzaldehyde to toluene?

Marks : (2)

Ans: Clemmensen reduction, Zn amalgam and Con. HCl

Que 19: Stephen reduction is used to convert to

Marks : (1)

Ans: nitriles to aldehydes

Que 20: Esters and nitriles can be selectively reduced to aldehydes using.....

Marks : (1)

Ans: DIBAL-H

Que 21: Nitration of benzaldehyde is Marks : (1)

Ans: Meta nitrobenzaldehyde

Que 22: Explain the structure of carbonyl group and give reason for its polar nature.

Marks : (3)

Ans: Carbonyl group is planar with C atom is in sp^2 hybridisation. The unhybridised p orbital of C atom undergoes lateral overlapping with half-filled p orbital of oxygen atom forming a pi bond.

Due to the high electro negativity of oxygen atom compared to C atom.