Aldehydes, Ketones & Carboxylic acids

Que 1: Arrange the following carboxylic acids in the increasing order of acidic strength. Justify your answer. ***Marks :(2)***

CF_3 COOH, CH_3COOH, C_6H_5COOH

Ans: $CH_3COOH < C_6H_5COOH < CF_3$ 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	**H_2/Pd – $BaSO_4$**	
CH_3 CH_2 COOH		**Hell Volhard Zelinsky**
CH_3COONa		**Kolbe's electrolysis**

CH_3COCH_3 KOH/Ethylene glycol

Ans:

Substrate	Reagent	Name of reaction
Benzoyl chloride	$H_2/Pd - BaSO_4$	Rosenmund reduction
$CH_3 CH_2 COOH$	Red P/Cl_2	Hell Volhard Zelinsky
CH_3COONa	Electrolysisof 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, $ClCH_2CH_2COOH$, $ClCH_2COOH$ ***Marks :(1)***

Ans: $CH_3COOH < ClCH_2CH_2COOH < ClCH_2COOH < FCH_2COOH$

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: $CH_3CN + H^+/H2O \rightarrow CH_3COOH$

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:

1. $$RCOCl + H2 \xrightarrow{Pd-BaSO4} RCHO + HCl$$

2. R C= N +$SnCl_2$ +HCl → [RCH=NH] → RCHO.

3. C_6H_5 CH_3 + CrO_2Cl_2 → $C_6H_5CH(OCrOHCl_2)$ → C_6H_5CHO

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 alpha hydrogen, undergoes Cannizzaro's reaction with con NaOH to give salt of carboxylic acid and an alcohol

2 C_6H_5COOH + NaOH →C_6H_5COONa + $C_6H_5CH_2OH$

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

$2CH_3CHO$→ $CH_3CH(OH)CH_2CHO$→ $CH_3CH=CHCHO$

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 silvernitrate solution gives silver mirror bur propanone does not answer the test.

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

i) hydroxylamine ii) Hydrogencyanide

Ans: $CH_3CH=O$ + NH_2OH →$CH_3CH=NOH$ (OXIME)

$CH_3CH=O$ + HCN→$CH_3CH(CN)OH$ (CYANOHYDRIN)

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 anhybridised p orbital of C atom undergoes latteral 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.