Ordinary Thinking

Objective Questions

General Introduction of Carboxylic Acids and Their Derivatives

1. Identify the wrong statement from the following **[Tamil Nadu CET 2002]**

(a) Salicylic acid's a monobasic acid
(b) Methyl salicylate is an ester
(c) Salicylic acid gives violet colour with neutral ferric chloride as well as brisk effervescence with sodium bicarbonate
(d) Methyl salicylate does not occur in natural oils

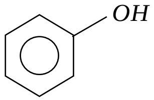
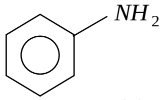
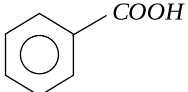
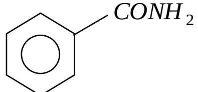
2. Which of the following is optically active **[BHU 1997]**

(a) Ethylene glycol (b) Oxalic acid
(c) Glycerol (d) Tartaric acid

3. Palmitic acid is **[BHU 1997]**

(a) $C_{16}H_{31}COOH$ (b) $C_{17}H_{35}COOH$
(c) $C_{15}H_{31}COOH$ (d) $C_{17}H_{31}COOH$

4. Which one among the following represents an amide **[MP PMT 1993]**

(a) 
(b) 
(c) 
(d) 

5. The name of the compound having the structure $ClCH_2CH_2COOH$ is **[MP PET 1993]**

(a) 3-chloropropanoic acid (b) 2-chloropropanoic acid
(c) 2-chloroethanoic acid (d) Chlorosuccinic acid

6. Fats and oils are mixture of **[CPMT 1993]**

(a) Glycerides and saturated fatty acids
(b) Glycerides and unsaturated fatty acids
(c) Glycerides of saturated and unsaturated fatty acids
(d) Only saturated and unsaturated fatty acids

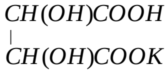
7. Which one is not a glyceride **[CPMT 1994]**

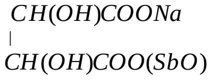
(a) Fat (b) Oil
(c) Phospholipid (d) Soaps

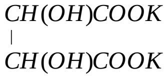
8. $(RCO)_2NH$ is

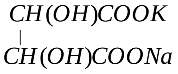
(a) Primary amine (b) Secondary amine
(c) Secondary amide (d) Tertiary amide

9. Which of the following is the formula of tartaremetic **[Manipal MEE 1995]**

(a) 
$\begin{array}{l} CH(OH)COOH \\ | \\ CH(OH)COOK \end{array}$

(b) 
$\begin{array}{l} CH(OH)COONa \\ | \\ CH(OH)COO(SbO) \end{array}$

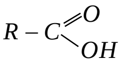
(c) 
$\begin{array}{l} CH(OH)COOK \\ | \\ CH(OH)COOK \end{array}$

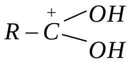
(d) 
$\begin{array}{l} CH(OH)COOK \\ | \\ CH(OH)COONa \end{array}$

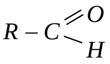
10. Which compound is known as oil of winter green **[MP PET/PMT 1998; CPMT 2002]**

(a) Phenyl benzoate (b) Phenyl salicylate
(c) Phenyl acetate (d) Methyl salicylate

11. Which of the following structure of carboxylic acid accounts for the acidic nature **[JIPMER 1997]**

(a) 
$R-C\begin{array}{l} \nearrow O \\ \searrow OH \end{array}$

(b) 
$R-\overset{+}{C}\begin{array}{l} \nearrow OH \\ \searrow OH \end{array}$

(c) 
$R-C\begin{array}{l} \nearrow O \\ \searrow H \end{array}$

(d) None of these

12. Acetoacetic ester behaves as **[CPMT 1988]**

(a) An unsaturated hydroxy compound
(b) A keto compound
(c) Both of these ways
(d) None of these

13. The general formula $(RCO)_2O$ represents **[CPMT 1974; DPMT 1982; MP PMT 1996]**

(a) An ester (b) A ketone
(c) An ether (d) An acid anhydride

14. A tribasic acid is

(a) Oxalic acid (b) Tartaric acid
(c) Lactic acid (d) Citric acid

15. Amphiphilic molecules are normally associated with **[Orissa JEE 1997]**

(a) Isoprene based polymers
(b) Soaps and detergents
(c) Nitrogen based fertilizers e.g. urea
(d) Pain relieving medicines such as aspirin

16. Wax are long chain compounds belonging to the class **[CPMT 1982, 93]**

(a) Acids (b) Alcohols
(c) Esters (d) Ethers

17. Glycine may be classed as all of the following except **[JIPMER 1997]**

(a) A base (b) An acid
(c) A zwitter ion (d) Optically active acid

18. Which of the following is not a fatty acid **[CPMT 1988]**

(a) Stearic acid (b) Palmitic acid
(c) Oleic acid (d) Phenyl acetic acid

19. Vinegar obtained from canesugar contains **[CPMT 1980; DPMT 1982; KCET 1992; MP PMT 1994; AIIMS 1999]**

(a) Citric acid (b) Lactic acid
(c) Acetic acid (d) Palmitic acid

20. The general formula for monocarboxylic acids is **[CPMT 2003]**

(a) C_nH_nCOOH (b) $C_nH_{2n+1}COOH$
(c) $C_nH_{2n-1}COOH$ (d) $C_nH_{2n}O_2$

21. Number of oxygen atoms in a acetamide molecule is

(a) 1 (b) 2
(c) 3 (d) 4

22. Urea is **[CPMT 1984]**

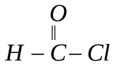
(a) Monoacidic base (b) Diacidic base
(c) Neutral (d) Amphoteric

23. Fats and oils are **[CPMT 1990]**

(a) Acids (b) Alcohols
(c) Esters (d) Hydrocarbons

24. The general formulas $C_nH_{2n}O_2$ could be for open chain **[AIEEE 2003]**

(a) Diketones (b) Carboxylic acids
(c) Diols (d) Dialdehydes

25. 
$H-\overset{\overset{O}{\|}}{C}-Cl$ is called

(a) Acetyl chloride (b) Formyl chloride
(c) Chloretone (d) Oxochloromethane

26. Urea

(a) Is an amide of carbonic acid
(b) It is diamide of carbonic acid
(c) Gives carbonic acid on hydrolysis
(d) Resembles carbonic acid

27. Which of the following acids is isomeric with phthalic acid

(a) Succinic acid
(b) Salicylic acid
(c) 1, 4-benzene dicarboxylic acid
(d) Methyl benzoic

28. The ester among the following is **[Kerala PMT 2003]**

(a) Calcium lactate
(b) Ammonium acetate
(c) Sodium acetate
(d) None of these

29. Sodium or potassium salts of higher fatty acids are called **[MP PET 2003]**

(a) Soaps
(b) Terpenes
(c) Sugars
(d) Alkaloids

30. Formamide is

(a) $HCONH_2$
(b) CH_3CONH_2
(c) $HCOONH_4$
(d) $(HCHO + NH_3)$

31. Oleic, stearic and palmitic acids are **[CPMT 1997]**

(a) Nucleic acids
(b) Amino acids
(c) Fatty acids
(d) None of these

32. Which one is called ethanoic acid **[CPMT 1997]**

(a) $HCOOH$
(b) CH_3COOH
(c) CH_3CH_2COOH
(d) $CH_3CH_2CH_2COOH$

33. Vinegar is **[CPMT 1997]**

(a) $HCHO$
(b) $HCOOH$
(c) CH_3CHO
(d) CH_3COOH

34. Which of these do not contain $-COOH$ group **[CPMT 1997]**

(a) Aspirin
(b) Benzoic acid
(c) Picric acid
(d) Salicylic acid

35. Vinegar obtained from sugarcane has **[AFMC 2005]**

(a) CH_3COOH
(b) $HCOOH$
(c) C_6H_5COOH
(d) CH_3CH_2COOH

36. Carbolic acid is **[AFMC 2005]**

(a) C_6H_5CHO
(b) C_6H_6
(c) C_6H_5COOH
(d) C_6H_5OH

37. The most acidic of the following is **[J & K 2005]**

(a) $ClCH_2COOH$
(b) C_6H_5COOH
(c) CD_3COOH
(d) CH_3CH_2COOH

38. Which is most reactive of the following **[J & K 2005]**

(a) Ethyl acetate
(b) Acetic anhydride
(c) Acetamide
(d) Acetyl chloride

Preparation of Carboxylic Acids and Their Derivatives

1. Hydrolysis of $CH_3CH_2NO_2$ with 85% H_2SO_4 gives **[KCET 1996]**

(a) CH_3CH_2OH
(b) C_2H_6
(c) $CH_3CH = NOH$
(d) CH_3COOH

2. When formic acid reacts with PCl_5 it forms **[MNR 1982]**

(a) Formyl chloride
(b) Acetyl chloride
(c) Methyl chloride
(d) Propionyl chloride

3. Laboratory method for the preparation of acetyl chloride is **[RPMT 2003]**

(a) $CH_3COOH + SOCl_2 \rightarrow CH_3COCl$
(b) $CH_3COOH + PCl_3 \rightarrow CH_3COCl$
(c) $CH_3COONa + PCl_3 \rightarrow CH_3COCl$
(d) All of these

4. Tischenko reaction yields ester in the presence of catalyst which is

(a) $LiAlH_4$
(b) *N*-bromosuccinamide
(c) $Al(OC_2H_5)_3$
(d) $Zn - Hg / HCl$

5. Acetic acid is obtained when **[NCERT 1975; CPMT 1977]**

(a) Methyl alcohol is oxidised with potassium permanganate
(b) Calcium acetate is distilled in the presence of calcium formate
(c) Acetaldehyde is oxidised with potassium dichromate and sulphuric acid
(d) Glycerol is heated with sulphuric acid

6. Acetic acid is manufactured by the fermentation of **[CPMT 1985]**

(a) Ethanol
(b) Methanol
(c) Ethanal
(d) Methanal

7. $CO + NaOH \rightarrow$ **[CPMT 1997; KCET 1999]**

(a) $HCOONa$
(b) $C_2H_2O_4$
(c) $HCOOH$
(d) CH_3COOH

8. Carboxylic acids react with diazomethane to form **[MP PMT/PET 1988; MP PMT 1990]**

(a) Amine
(b) Alcohol
(c) Ester
(d) Amide

9. $C_2H_2 \xrightarrow[H_2SO_4]{HgOH\ 1\%} A \xrightarrow{[O]} B$, B is **[CBSE PMT 1991; BHU 1995]**

(a) An acid
(b) An aldehyde
(c) A ketone
(d) Ethanol

10. Reimer-Tiemann reaction involves a **[MP PET 1997]**

(a) Carbonium ion intermediate
(b) Carbene intermediate
(c) Carbanion intermediate
(d) Free radical intermediate

11. The product D of the reaction

$CH_3Cl \xrightarrow{KCN} (A) \xrightarrow{H_2O} (B) \xrightarrow{NH_3} (C) \xrightarrow{\Delta} (D)$ is **[MP PET 1997]**

(a) $CH_3CH_2NH_2$
(b) CH_3CN
(c) $HCONH_2$
(d) CH_3CONH_2

12. Which of the following on hydrolysis forms acetic acid **[BHU 1997]**

(a) CH_3CN
(b) CH_3OH
(c) C_2H_5OH
(d) $C_2H_5NH_2$

13. When benzyl alcohol is oxidised with $KMnO_4$, the product obtained is **[SCRA 1991]**

(a) Benzaldehyde
(b) Benzoic acid
(c) CO_2 and H_2O
(d) None of these

14. Which of the following gives benzoic acid on oxidation **[CBSE PMT 1996]**

(a) Chlorophenol
(b) Chlorotoluene
(c) Chlorobenzene
(d) Benzyl chloride

15. $(CH_3)_2CO \xrightarrow[(HCl)]{NaCN} A \xrightarrow[\Delta]{H_3O^+} B$ In the above sequence of reactions A and B are **[CPMT 2000]**

(a) $(CH_3)_2C(OH)CN, (CH_3)_2C(OH)COOH$
(b) $(CH_3)_2C(OH)CN, (CH_3)_2C(OH)_2$
(c) $(CH_3)_2C(OH)CN, (CH_3)_2CHCOOH$
(d) $(CH_3)_2C(OH)CN, (CH_3)_2C = O$

16. Two moles of acetic acid are heated with P_2O_5. The product formed is [MP PET/PMT 1988]

(a) 2 moles of ethyl alcohol
(b) Formic anhydride
(c) Acetic anhydride
(d) 2 moles of methyl cyanide

17. Formic acid is obtained when [NCERT 1974]

(a) Calcium acetate is heated with conc. H_2SO_4
(b) Calcium formate is heated with calcium acetate
(c) Glycerol is heated with oxalic acid at 110^oC
(d) Acetaldehyde is oxidised with $K_2Cr_2O_7$ and H_2SO_4

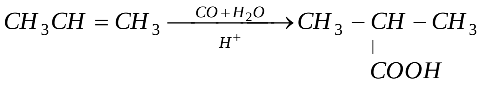
18. Acetyl chloride cannot be obtained by treating acetic acid with

(a) $CHCl_3$ (b) $SOCl_2$
(c) PCl_3 (d) PCl_5

19. *o*-xylene when oxidised in presence of V_2O_5 the product is

(a) Benzoic acid (b) Phenyl acetic acid
(c) Phthalic acid (d) Acetic acid

20. The reaction



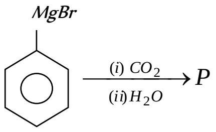
$$CH_3CH=CH_3 \xrightarrow[H^+]{CO+H_2O} CH_3-\underset{\underset{COOH}{|}}{CH}-CH_3$$

is known as [MP PMT 2002]

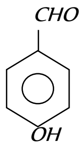
(a) Wurtz reactions
(b) Koch reaction
(c) Clemenson's reduction
(d) Kolbe's reaction

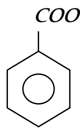
21. By aerial oxidation, which one of the following gives phthalic acid[Tamil Nadu CET 2002]

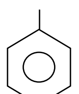
(a) Naphthalene (b) Banzene
(c) Mesitylene (d) Toluene

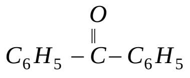
22.  In the reaction, product P is

[CBSE PMT 2002]

(a) 

(b) 

(c) 

(d) 

$C_6H_5-\overset{\overset{O}{\|}}{C}-C_6H_5$

23. Glacial acetic is obtained by [KCET 2002]

(a) Distilling vinegar
(b) Crystallizing separating and melting acetic acid
(c) Treating vinegar with dehydrating agent
(d) Chemically separating acetic acid

24. In esterification, OH^- ion for making H_2O comes from [CPMT 1996]

(a) Acid (b) Alcohol
(c) Ketone (d) Carbohydrate

25. Heating a mixture of ethyl alcohol and acetic acid in presence of conc. H_2SO_4 produces a fruity smelling compound. This reaction is called [AIIMS 1996]

(a) Neutralisation (b) Ester hydrolysis
(c) Esterification (d) Williamson's synthesis

26. Product formed by heating a mixture of ammonium chloride and potassium cyanate is

(a) N_2O (b) NH_3
(c) CH_3NH_2 (d) H_2NCONH_2

27. Rearrangement of an oxime to an amide in the presence of strong acid is called [Kerala CET 2000]

(a) Curtius rearrangement (b) Fries rearrangement
(c) Backman rearrangement (d) Sandmeyer reaction

28. Which reagent will bring about the conversion of carboxylic acids into esters [CBSE PMT 2000]

(a) C_2H_5OH (b) Dry $HCl+C_2H_5OH$
(c) $LiAlH_4$ (d) $Al(OC_2H_5)_3$

29. The acid formed when propyl magnesium bromide is treated with carbon dioxide is

[CPMT 1982, 84, 86; Pb. PMT 1998]

[CPMT 1985]

(a) C_3H_7COOH (b) C_2H_5COOH
(c) Both (a) and (b) (d) None of the above

30. CO_2 on reaction with ethyl magnesium bromide gives [BHU 1983]

(a) Ethane (b) Propanoic acid
(c) Acetic acid (d) None of these

31. Acetic anhydride is obtained from acetyl chloride by the reaction of

(a) P_2O_5 (b) H_2SO_4
(c) CH_3COONa (d) CH_3COOH

32. Hydrolysis of acetamide produces [DPMT 1984; MP PMT 1994; MP PET 2001]

(a) Acetic acid (b) Acetaldehyde
(c) Methylamine (d) Formic acid

33. Ethyl acetate is obtained when methyl magnesium iodide reacts with[Tamil Nad

(a) Ethyl formate (b) Ethyl chloroformate
(c) Acetyl chloride (d) Carbon dioxide

34. Sodium acetate reacts with acetyl chloride to form [BIT 1992]

(a) Acetic acid (b) Acetone
(c) Acetic anhydride (d) Sodium formate

35. Ammonium acetate reacts with acetic acid at 110^oC to form

(a) Acetamide (b) Formamide
(c) Ammonium cyanate (d) Urea

36. Tischancko reaction is used for preparation of

(a) Ether (b) Ester
(c) Amide (d) Acid anhydride

37. The silver salt of a fatty acid on refluxing with an alkyl halide gives an [KCET 2004]

(a) Acid (b) Ester
(c) Ether (d) Amine

38. Which reaction is used for the preparation of $\alpha-$ Bromoacetic acid ? [MP PET 2004; MP PET/PMT 1998]

(a) Kolbe's Reaction
(b) Reimer-Tiemann Reaction
(c) Hell volhard Zelinsky Reaction
(d) Perkin's Reation

39. Tertiary alcohols (3°) having atleast four carbon atoms upon drastic oxidation yield carboxylic acid with [MH CET 2004]

(a) One carbon atom less
(b) Two carbon atoms less
(c) Three carbon atom less
(d) All the above three options are correct

40. When succinic acid is heated, product formed is [Pb. CET 2000]

(a) Succinic anhydride (b) Acetic acid
(c) CO_2 and methane (d) Propionic acid

41. In the reaction, $C_6H_5OH \xrightarrow{NaOH} (A) \xrightarrow[140^\circ C,\,(4-7\,\text{atm})]{CO_2} (B)$

$\xrightarrow{HCl} (C)$, the compound (C) is **[Pb. CET 2001]**

(a) Benzoic acid (b) Salicylaldehyde

(c) Chlorobenzene (d) Salicylic acid

42. When an acyl chloride is heated with Na salt of a carboxylic acid, the product is **[DCE 2003]**

(a) An ester (b) An anhydride

(c) An alkene (d) An aldehyde

43. The compound X, in the reaction, is

$$X \xrightarrow{CH_3MgI} Y \xrightarrow{\text{hydrolysis}} Mg(OH)I + CH_3COOH$$

[Pb. CET 2003]

(a) CH_3CHO (b) CO_2

(c) $(CH_3)_2CO$ (d) $HCHO$

44. $CH_3CONH_2 \xrightarrow{NaNO_2/HCl} X$ **[Pb. CET 2003]**

(a) CH_3COOH (b) $CH_3CO\overset{+}{N}H_3Cl^-$

(c) CH_3NH_2 (d) CH_3CHO

45. Primary aldehyde on oxidation gives **[DPMT 20004]**

(a) Esters (b) Carboxylic acid

(c) Ketones (d) Alcohols

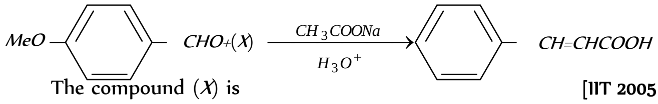
46. Toluene is oxidised to benzoic acid by

[BHU 2004; CPMT 1985]

(a) $KMnO_4$ (b) $K_2Cr_2O_7$

(c) H_2SO_4 (d) Both (a) and (b)

47.



The compound (X) is **[IIT 2005]**

(a) CH_3COOH (b) $BrCH_2 - COOH$

(c) $(CH_3CO)_2O$ (d) $CHO - COOH$

48. Salicylic acid is prepared from phenol by **[AFMC 2005]**

(a) Reimer Tiemann reaction

(b) Kolbe's reaction

(c) Kolbe-electrolysis reaction

(d) None of these

49. Acetic acid will be obtained on oxidation of **[J & K 2005]**

(a) Ethanol (b) Propanal

(c) Methanal (d) Glyoxal

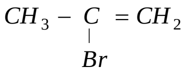
Properties of Carboxylic Acids and Their Derivatives

1. Which of the following acids has the smallest dissociation constant **[IIT-JEE (Screening) 2002]**

(a) $CH_3CHFCOOH$ (b) FCH_2CH_2COOH

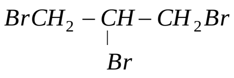
(c) $BrCH_2CH_2COOH$ (d) $CH_3CHBrCOOH$

2. What is obtained, when propene is treated with *N*-bromo succinimide **[MP PMT 2003]**

(a)

$CH_3 - \underset{\underset{Br}{|}}{C} = CH_2$

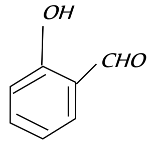
(b) $BrCH_2 - CH = CH_2$

(c) $BrCH_2 - CH = CHBr$

(d)

$BrCH_2 - \underset{\underset{Br}{|}}{CH} - CH_2Br$

3. What will be the product, when carboxy phenol, obtained by Reimer Tiemann's process, is deoxidised with *Zn* powder

[MP PMT 2003]

(a)


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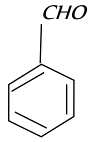
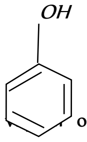


(c)


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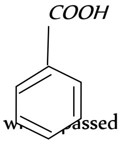


4. The of a carboxylic acid HA w assed over MnO_2 at 573 K yields propanone. The acid HA is

(a) Methanoic acid (b) Ethanoic acid

(c) Propanoic acid (d) Butanoic acid

5. Which acid is strongest **or** Which is most acidic

[CPMT 1982, 89; BIT 1992; MP PET 1996; MP PMT/PET 1988; MP PMT 1995, 97;RPMT 1997]

(a) $Cl_2CH.COOH$ (b) $ClCH_2COOH$

(c) CH_3COOH (d) $Cl_3C.COOH$

6. Ethyl acetate at room temperature is a

(a) Solid (b) Liquid

(c) Gas (d) Solution

7. Urea is a better fertilizer than ammonium sulphate because

(a) It has greater percentage of nitrogen

(b) It is more soluble

(c) It is weakly basic

(d) It does not produce acidity in soil

8. The reaction of acetamide with water is an example of

[Kurukshetra CEE 1998; RPMT 2000]

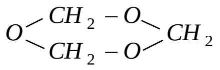
(a) Alcoholysis (b) Hydrolysis

(c) Ammonolysis (d) Saponification

9. The acid which reduces Fehling solution is **[KCET 1998]**

(a) Methanoic acid (b) Ethanoic acid

(c) Butanoic acid (d) Propanoic acid

10.


The above shown polymer is obtained when a carbon compound is allowed to stand. It is a white solid. The polymer is

(a) Trioxane (b) Formose

(c) Paraformaldehyde (d) Metaldehyde

11. What will happen if $LiAlH_4$ is added to an ester

[CBSE PMT 2000]

(a) Two units of alcohol are obtained

(b) One unit of alcohol and one unit of acid is obtained

(c) Two units of acids are obtained

(d) None of these

12. When anisole is heated with *HI*, the product is

[CET Pune 1998]

(a) Phenyl iodide and methyl iodide

(b) Phenol and methanol

(c) Phenyl iodide and methanol

(d) Methyl iodide and phenol

13. When CH_3COOH reacts with $CH_3 - Mg - X$ **[BVP 2003]**

(a) CH_3COX is formed (b) Hydrocarbon is formed

(c) Acetone is formed (d) Alcohol is formed

14. Which class of compounds shows *H*-bonding even more than in alcohols

(a) Phenols (b) Carboxylic acids

(c) Ethers (d) Aldehydes

15. When propanamide reacts with Br_2 and $NaOH$ then which of the following compound is formed[**Manipal 2001**]

(a) Ethyl alcohol (b) Propyl alcohol
(c) Propyl amine (d) Ethylamine

16. Hydrolysis of an ester gives a carboxylic acid which on Kolbe's electrolysis yields ethane. The ester is

[**EAMCET 1997; Manipal PMT 2001**]

(a) Ethyl methonoate (b) Methyl ethanoate
(c) Propylamine (d) Ethylamine

17. On prolonged heating of ammonium cyanate or urea, we get[**DPMT 1982; CPMT 1979; MP PMT 1996**]

(a) N_2 (b) CO_2
(c) Biurette (d) Ammonium carbonate

18. In the Gabriel's phthalimide synthesis, phthalimide is treated first with

(a) C_2H_5I / KOH (b) Ethanolic *Na*
(c) Ethanol and H_2SO_4 (d) Ether and $LiAlH_4$

19. Which of the following is the strongest acid [**NCERT 1984**]

(a) CH_3COOH (b) $BrCH_2COOH$
(c) $ClCH_2COOH$ (d) FCH_2COOH

20. Which of the following reduces Tollen's reagent

[**MP PMT 1991**]

(a) Acetic acid (b) Citric acid
(c) Oxalic acid (d) Formic acid

21. Oxalic acid may be distinguished from tartaric acid by

(a) Sodium bicarbonate solution
(b) Ammonical silver nitrate solution
(c) Litmus paper
(d) Phenolphthalein

22. The reaction of *HCOOH* with conc. H_2SO_4 gives

[**DPMT 1982, CPMT 1989; MP PET 1995; AIIMS 2000; Manipal 2001; Pb. CET 2002**]

(a) CO_2 (b) CO
(c) Oxalic acid (d) Acetic acid

23. Sulphonation of benzoic acid produces mainly [**CPMT 1982**]

(a) *o*-sulphobenzoic acid
(b) *m*-sulphobenzoic acid
(c) *p*-sulphobenzoic acid
(d) *o*- and *p*-sulphobenzoic acid

24. Which one is strongest acid [**MP PMT 1992**]

(a) CH_2FCOOH (b) $CH_2ClCOOH$
(c) $CHCl_2COOH$ (d) CHF_2COOH

25. Which does not give silver mirror with ammoniacal $AgNO_3$

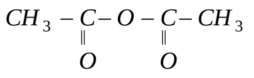
[**MP PET 1992**]

(a) $HCHO$ (b) CH_3CHO
(c) CH_3COOH (d) $HCOOH$

26. $2CH_3COOH \xrightarrow[300^oC]{MnO} A$, product '*A*' in the reaction is

[**RPMT 2003**]

(a) CH_3CH_2CHO (b) CH_3-CH_2-OH
(c) CH_3COCH_3 (d)



$CH_3-\underset{\underset{O}{\|}}{C}-O-\underset{\underset{O}{\|}}{C}-CH_3$

27. Acetic acid is weak acid than sulphuric acid because

[**CPMT 2003**]

(a) It decompose on increasing temperature
(b) It has less degree of ionisation
(c) It has – *COOH* group
(d) None of these

28. In CH_3COOH and *HCOOH*, *HCOOH* will be

[**CPMT 1975; DPMT 1982**]

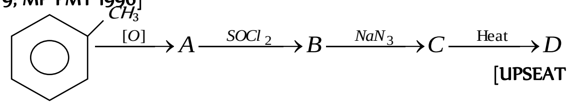
(a) Less acidic (b) Equally acidic
(c) More acidic (d) None

29. Acetic anhydride reacts with excess of ammonia to form

[**MP PET 1992**]

(a) $2CH_3COONH_4$
(b) $2CH_3CONH_2$
(c) $CH_3CONH_2 + CH_3COONH_4$
(d) $2CH_3COOH$

30. In the following sequence of reactions, what is *D*



[**UPSEAT 2002**]

(a) Primary amine
(b) An amide
(c) Phenyl isocyanate
(d) A chain lengthened hydrocarbon

31. Hydrolytic reaction of fats with caustic soda is known as

[**MP PMT/PET 1988; AMU 1988; KCET 2000; MP PET 2001**]

(a) Esterification (b) Saponification
(c) Acetylation (d) Carboxylation

32. In the reaction

$CH_3COOH \xrightarrow{LiAlH_4} (A) \xrightarrow{I_2+NaOH} (B) \xrightarrow{Ag(\text{Dust})} (C)$

the final product (*C*) is

(a) C_2H_5I (b) C_2H_5OH
(c) C_2H_2 (d) CH_3COCH_3

33. Reaction of ethyl formate with excess of CH_3MgI followed by hydrolysis gives [**IIT (Screening) 1992**]

(a) *n*-propyl alcohol (b) Ethanal
(c) Propanal (d) Isopropyl alcohol

34. Of the following four reactions, formic and acetic acids differ in which respect [**CPMT 1990, 93**]

(a) Replacement of hydrogen by sodium
(b) Formation of ester with alcohol
(c) Reduction of Fehling solution
(d) Blue litmus reaction

35. Formaldehyde and formic acid can be distinguished using

[**AFMC 1993**]

(a) Tollen's reagent (b) Fehling solution
(c) Ferric chloride (d) Sodium bicarbonate

36. Ester and acetamide are distinguished by [**BHU 1996**]

(a) Hydrolysis with strong acids or alkali
(b) Derivatives of fatty acids
(c) Both (a) and (b)
(d) None of these

37. Acetic acid exists as a dimer in benzene solution. This is due to

[**MP PMT 1989; CPMT 1982**]

(a) Condensation
(b) Presence of $-COOH$ group
(c) Presence of $\alpha -$ hydrogen
(d) Hydrogen bonding

38. Which of the following compounds will react with $NaHCO_3$ solution to give sodium salt and carbon dioxide

[**CBSE PMT 1999; BHU 1983, 2002**]

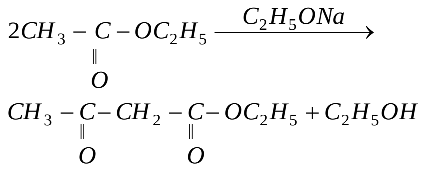
(a) Phenol (b) *n*-hexanol
(c) Acetic acid (d) Both (a) and (b)

39. Acetic acid dissolved in benzene shows a molecular mass of

[**MP PET 1993**]

(a) 30 (b) 60
(c) 120 (d) 240

40. The reaction



$$2CH_3-\underset{\underset{O}{\|}}{C}-OC_2H_5 \xrightarrow{C_2H_5ONa} CH_3-\underset{\underset{O}{\|}}{C}-CH_2-\underset{\underset{O}{\|}}{C}-OC_2H_5+C_2H_5OH$$

is called [MP PMT 2003; KCET 1996]

(a) Etard reaction (b) Perkin's reaction

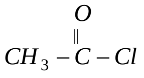
(c) Claisen condensation (d) Claisen Schmidt reaction

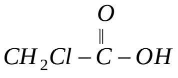
41. Which is the strongest acid ? (*pKa* value is given in the bracket) [MP PMT 1997; BHU 2003]

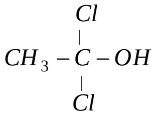
(a) $HCOOH\,(3.77)$ (b) $C_6H_5COOH\,(4.22)$

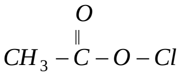
(c) $CH_3COOH\,(4.71)$ (d) $CH_3CH_2COOH\,(4.88)$

42. In the presence of iodine catalyst, chlorine reacts with acetic acid to form [MP PMT 1997]

(a)  $CH_3-\overset{\overset{O}{\|}}{C}-Cl$

(b)  $CH_2Cl-\overset{\overset{O}{\|}}{C}-OH$

(c)  $CH_3-\overset{\overset{Cl}{|}}{\underset{\underset{Cl}{|}}{C}}-OH$

(d)  $CH_3-\overset{\overset{O}{\|}}{C}-O-Cl$

43. The acid showing salt-like character in aqueous solution is [MP PET/PMT 1998]

(a) Acetic acid (b) Benzoic acid

(c) Formic acid (d) $\alpha-$ amino acetic acid

44. $CH_3COOH \xrightarrow[P_2O_5]{\Delta} X$. Identify X [JIPMER 2000; CPMT 2003]

(a) CH_3COCH_3 (b) CH_3CHO

(c) $(CH_3CO)_2O$ (d) CH_4

45. Formic acid [MP PET/PMT 1988]

(a) Is immiscible with water

(b) Reduces the ammonical silver nitrate

(c) Is a weak acid nearly three and a half time weaker than acetic acid

(d) Is prepared by heating potassium hydroxide

46. Given below are some statements concerning formic acid, which of them is true [CPMT 1983]

(a) It is a weaker acid than acetic acid

(b) It is a reducing agent

(c) When its calcium salt is heated, it forms a ketone

(d) It is an oxidising agent

47. Which decolourises the colour of acidic $KMnO_4$ [CPMT 1991]

(a) CH_3COOH (b) CH_3CH_2COOH

(c) $COOH.COOH$ (d) $CH_3COOC_2H_5$

48. A colourless water soluble organic liquid decomposes sodium carbonate and liberates carbon dioxide. It produces black precipitate with Tollen's reagent. The liquid is [KCET 1989]

(a) Acetaldehyde (b) Acetic acid

(c) Formaldehyde (d) Formic acid

49. The end product B in the sequence of reactions

$R-X \xrightarrow{CN^-} A \xrightarrow{NaOH} B$ is [CPMT 1985]

(a) An alkane

(b) A carboxylic acid

(c) Sodium salt of carboxylic acid

(d) A ketone

50. $CH_3CH_2COOH \xrightarrow{Cl_2/Fe} X \xrightarrow[KO_4]{Alcoholic} Y$

Compound Y is [DPMT 1981; JIPMER 2000; AIEEE 2002]

(a) CH_3CH_2OH (b) CH_3CH_2CN

(c) $CH_2=CHCOOH$ (d) $CH_3CHClCOOH$

51. In the precipitation of soap, which can be used instead of $NaCl$

(a) Na (b) CH_3COONa

(c) Na_2SO_4 (d) Sodium silicate

52. Which of the following can possibly be used as analgesic without causing addiction and moon modification [CBSE PMT 1997]

(a) Morphine

(b) *N*-acetyl-para-aminophenol

(c) Drazepom

(d) Tetrahydrocatinol

53. Which of the following esters cannot undergo Claisen self condensation [CBSE PMT 1998]

(a) $CH_3-CH_2-CH_2-CH_2-COOC_2H_5$

(b) $C_6H_5COOC_2H_5$

(c) $C_6H_5CH_2COOC_2H_5$

(d) $C_6H_{11}CH_2COOC_2H_5$

54. When acetic acid is dissolved in benzene its molecular mass [AFMC 1991]

(a) Decreases

(b) Increases

(c) Either increases or decreases

(d) Suffers no change

55. Benzoic acid has higher molecular weight in benzene and less in water because

(a) Water has lower freezing point and higher boiling point than benzene

(b) It dissociates to a greater extent in benzene than in water

(c) It associates in water and dissociates in benzene

(d) It dissociates in water and associates in benzene

56. What is the main reason for the fact that carboxylic acids can undergo ionization [MNR 1993; Pb. PMT 2004]

(a) Absence of $\alpha-$ hydrogen

(b) Resonance stabilisation of the carboxylate ion

(c) High reactivity of $\alpha-$ hydrogen

(d) Hydrogen bonding

57. Which of the following compounds will evolve hydrogen on treatment with metal [CPMT 1974]

(a) C_2H_5OH (b) CH_3COOH

(c) (a) and (b) both (d) None of these

58. When urea is heated, it forms biurette, alkaline solution of which forms ..... with $CuSO_4$ solution [AFMC 1980]

(a) Violet colour (b) Red colour

(c) Green colour (d) Black colour

59. Which of the following would be expected to be most highly ionised in water [AIIMS 1982]

(a) $CH_2ClCH_2CH_2COOH$ (b) $CH_3CHCl.CH_2.COOH$

(c) $CH_3.CH_2.CCl_2.COOH$ (d) $CH_3.CH_2.CHCl.COOH$

60. Alkaline hydrolysis of esters is known as [CPMT 1986, 88, 93; MNR 1986; MP PET 1993]

(a) Saponification (b) Hydration

(c) Esterification (d) Alkalisation

61. Which of the following undergoes hydrolysis when dissolved in water [CPMT 1989]

(a) CH_3COONa (b) CH_3CONH_2

(c) Both (a) and (b) (d) $C_6H_5CH_3$

62. Name the end product in the following series of reactions

$CH_3COOH \xrightarrow{NH_3} A \xrightarrow[P_2O_5]{\Delta} B$ **[DPMT 1984]**

(a) CH_4 (b) CH_3OH

(c) Acetonitrile (d) Ammonium acetate

63. Reduction of carboxylic acids gives

(a) Alcohol with hydrogen in presence of palladium

(b) Alcohol with $LiAlH_4$

(c) Aldehyde with $LiAlH_4$

(d) Alcohol with $2HI(P)$

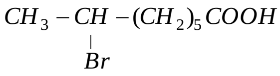
64. Which of the following substances when boiled with caustic soda solution will evolve ammonia **[BHU 1983]**

(a) Ethylamine (b) Aniline

(c) Acetamide (d) Acetoxime

65. $CH_2 = CH-(CH_2)_5COOH \xrightarrow[HBr]{\text{Peroxide}} Z$

where Z is **[CPMT 1996]**

(a) 
$CH_3-\underset{\substack{|\\Br}}{CH}-(CH_2)_5COOH$

(b) $BrCH_2-(CH_2)_6COOH$

(c) $CH_2 = CH-(CH_2)_5-CH_2OH$

(d) C_6H_5COOH

66. *HCOOH* shows all tests of aldehyde because **[CPMT 1996]**

(a) It has one aldehyde group

(b) It is member of aldehyde

(c) All acids show tests of aldehyde

(d) Does not show any test

67. Which one of the following orders of acid strength is correct **[CBSE PMT 2003]**

(a) $RCOOH > HC \equiv CH > HOH > ROH$

(b) $RCOOH > ROH > HOH > HC \equiv CH$

(c) $RCOOH > HOH > ROH > HC \equiv CH$

(d) $RCOOH > HOH > HC \equiv CH > ROH$

68. The order of decreasing rate of reaction with ammonia is **[Pb. PMT 1998]**

(a) Anhydrides, esters, ethers

(b) Anhydrides, ethers, esters

(c) Ethers, anhydrides, esters

(d) Esters, ethers, anhydrides

69. Oxidation of toluene with CrO_3 in the presence of $(CH_3CO)O_2$ gives a product '*A*' which on treatment with aqueous *NaOH* produces **[CBSE PMT 1995]**

(a) C_6H_5CHO (b) $(C_6H_5CO)_2O$

(c) C_6H_5COONa (d) 2, 4-diacetyl toluene

70. CH_3COOCH_3 + excess $PhMgBr$

$\rightarrow$ product $\xrightarrow{H^+} X$

The product X is **[Orissa JEE 2005]**

(a) 1, 1-diphenylethanol

(b) 1, 1-diphenylmethanol

(c) Methyl phenylethanol

(d) Methyl phenylketone

71. Which of the following is most acidic **[MP PMT 1995]**

(a) Formic acid (b) Chloroacetic acid

(c) Propionic acid (d) Acetic acid

72. Urea on slow heating gives

(a) $NH_2CON.HNO_2$ (b) $NH_2CONHCONH_2$

(c) *HCNO* (d) $NH_2CONH_2.HNO_3$

73. The principal organic product formed in the following reaction is

$CH_2 = CH(CH_2)_8COOH + HBr \xrightarrow{\text{peroxide}}$

[Pb. PMT 1998]

(a) $CH_3CHBr(CH_2)_8COOH$

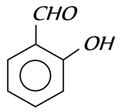
(b) $CH_2 = CH(CH_2)_8COBr$

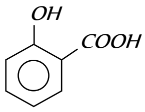
(c) $CH_2BrCH_2(CH_2)_8COOH$

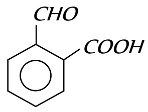
(d) $CH_2 = CH(CH_2)_7CHBrCOOH$

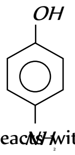
74. Which one of the following compound gives aspirin on reacting with acetic anhydride in presence of H_2SO_4

[EAMCET 2003]

(a) 

(b) 

(c) 

(d) 

75. An acyl halide is formed when PCl_5 reacts with an

[CBSE PMT 1994; AIIMS 1998; CBSE PMT 2002]

(a) Acid (b) Alcohol

(c) Amide (d) Ester

76. Which one of the following orders is wrong with respect to the property indicated **[CBSE PMT 1994]**

(a) Formic acid > acetic acid > propanoic acid (acid strength)

(b) Fluoroacetic acid > chloroacetic acid > bromoacetic acid (acid strength)

(c) Benzoic acid > phenol > cyclohexanol (acid strength)

(d) Aniline > cyclohexylamine > benzamide (basic strength)

77. A fruity smell is produced by the reaction of C_2H_5OH with

[AFMC 2000]

(a) PCl_5 (b) CH_3COCH_3

(c) CH_3COOH (d) None of these

78. Which of the following orders of relative strengths of acids is correct **[CPMT 2000]**

(a) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH$

(b) $ClCH_2COOH > BrCH_2COOH > FCH_2COOH$

(c) $BrCH_2COOH > ClCH_2COOH > FCH_2COOH$

(d) $ClCH_2COOH > FCH_2COOH > BrCH_2COOH$

79. When acetamide is treated with $NaOBr$, the product formed is**[Haryana CEET**

(a) CH_3CN (b) $CH_3CH_2NH_2$

(c) CH_3NH_2 (d) None of the above

80. The fatty acid which shows reducing property is

[Kerala CET 2000]

(a) Acetic acid (b) Ethanoic Acid

(c) Oxalic acid (d) Formic acid

81. The reagent that can be used to distinguish between methanoic acid and ethanoic acid is [Kerala CET 2001, 02]

(a) Ammoniacal silver nitrate solution

(b) Neutral ferric Chloride solution

(c) Sodium carbonate solution

(d) Phenolphthalein

82. Hydrolysis of an ester gives acid *A* and alcohol *B*. *A* reduces Fehling solution and oxidation of *B* gives *A*. The ester is

(a) Methyl formate (b) Ethyl formate

(c) Methyl acetate (d) Ethyl acetate

83. Order of reactivity is [RPMT 2003]

(a) $R-\overset{\overset{O}{\|}}{C}-X > RCONH_2 > RCOOCOR > RCOOR$

(b) $RCOX > RCOOCOR > RCOOR > RCONH_2$

(c) $RCOOR > RCONH_2 > RCOX > RCOOCOR$

(d) $RCOOCOR > RCOOR > RCOX > RCONH_2$

84. Right order of acidic strength is [RPMT 2003]

(a) $CH_2ClCOOH > HCOOH > C_2H_5COOH > CH_3COOH$

(b) $CH_2ClCOOH > HCOOH > CH_3COOH > C_2H_5COOH$

(c) $C_2H_5COOH > CH_3COOH > HCOOH > CH_2ClCOOH$

(d) $HCOOH > CH_2ClCOOH > CH_3COOH > C_2H_5COOH$

85. Saponification of ethyl benzoate with caustic soda as alkali gives

(a) Benzyl alcohol and ethanoic acid

(b) Sodium benzoate and ethanol

(c) Benzoic acid and sodium ethoxide

(d) Phenol and ethanoic acid

(e) Sodium benzoxide and ethanoic acid

86. Lactic acid on oxidation by alkaline potassium permanganate gives [Tamil Nadu CET 2002]

(a) Tartaric acid (b) Pyruvic acid

(c) Cinnamic acid (d) Propionic acid

87. $RCOOH \longrightarrow RCH_2OH$

This mode of reduction of an acid to alcohol can be affected only by

(a) Zn/HCl

(b) *Na*-alcohol

(c) Aluminium isopropoxide and isopropyl alcohol

(d) $LiAlH_4$

88. Which one of the following compounds forms a red coloured solution on treatment with neutral $FeCl_3$ solution [EAMCET 2003]

(a) CH_3COCH_3 (b) CH_3OCH_3

(c) CH_3CH_2OH (d) CH_3COOH

89. Urea can be tested by [UPSEAT 1999; BVP 2003]

(a) Benedict test (b) Mullicken test

(c) Ninhydrin (d) Biuret test

90. What are the organic products formed in the following reaction

$C_6H_5-COO-CH_3 \xrightarrow[2.\,H_2O]{1.\,LiAlH_4}$ [IIT 1995]

(a) C_6H_5-COOH and CH_4

(b) $C_6H_5-CH_2-OH$ and CH_4

(c) $C_6H_5-CH_3$ and CH_3-OH

(d) $C_6H_5-CH_2-OH$ and CH_3-OH

91. Reaction between an acid and alcohol will give [Roorkee 1995]

(a) Higher *C* containing acid (b) Secondary alcohol

(c) Alkane (d) Ester

92. Benzoic acid gives benzene on being heated with *X* and phenol gives benzene on being heated with *Y*. Therefore *X* and *Y* are respectively[CBSE PMT

(a) Sodalime and copper (b) *Zn* dust and *NaOH*

(c) *Zn* dust and sodalime (d) Sodalime and zinc dust

93. The product obtained when acetic acid is treated with phosphorus trichloride is [MP PMT 1999] [CPMT 1989, 93, 94; RPMT 1997; AIIMS 1998; EAMCET 1998]

(a) $CH_3COOPCl_3$ (b) CH_3COOCl

(c) CH_3COCl (d) $ClCH_2COOH$

94. Acetyl chloride is reduced with $LiAlH_4$ the product formed is

(a) Methyl alcohol (b) Ethyl alcohol

(c) Acetaldehyde (d) Acetone

95. In the preparation of an ester, the commonly used dehydrating agent is [KCET 1992]

(a) Phosphorus pentaxide

(b) Anhydrous calcium carbide

(c) Anhydrous aluminium chloride

(d) Concentrated sulphuric acid

96. In the esterification reaction of alcohols [KCET 1984]

(a) OH^- is replaced by C_6H_5OH

(b) H^+ is replaced by sodium metal

(c) OH^- is replaced by chlorine

(d) OH^- is replaced by CH_3COO^- group

97. Lower carboxylic acids are soluble in water due to [MP PET 1999]

(a) Low molecular weight (b) Hydrogen bonding

(c) Dissociation into ions (d) Easy hydrolysis

98. [Kerala (Med.) 2001] Acetamide reacts with P_2O_5 (phosphorus pentaoxide) to give

(a) Methyl cyanide (b) Methyl cyanate

(c) Ethyl cyanide (d) Ethyl isocyanate

99. The reaction

$CH_3COOH + Cl_2 \xrightarrow{P} ClCH_2COOH + HCl$ is called [NSE 2001; MP PET 2003]

(a) Hell-Volhard-Zelinsky reaction

(b) Birch reaction

(c) Rosenmund reaction

(d) Hunsdiecker reaction [CBSE PMT 1989]

100. An aqueous solution of urea [CPMT 1983]

(a) Is neutral

(b) Is acidic

(c) Is basic

(d) Can act as an acid and a base

101. Nitration of benzoic acid gives [MP PMT 1997]

(a) 3-nitrobenzoic acid (b) 2-nitrobenzoic acid

(c) 2, 3-dinitrobenzoic acid (d) 2, 4-dinitrobenzoic acid

102. The reagent used for converting ethanoic acid to ethanol is [KCET 1996; EAMCET 1998]

(a) $LiAlH_4$ (b) $KMnO_4$

(c) PCl_3 (d) $K_2Cr_2O_7/H^+$

103. Which one of the following has the maximum acid strength [NCERT 1983]

(a) *o*-nitrobenzoic acid (b) *m*-nitrobenzoic acid

(c) *p*-nitrobenzoic acid (d) *p*-nitrophenol

104. When benzoic acid is treated with PCl_5 at 100°*C*, it gives [Orissa JEE 2003]

(a) Benzoyl chloride (b) *o*-chlorobenzoic acid

(c) *p*-chlorobenzoic acid (d) Benzyl chloride

105. Oxalic acid on being heated upto $90^o C$ with conc. H_2SO_4 forms

[AFMC 1989; MP PET 1994; MP PMT 1989]

(a) $HCOOH + CO_2$ (b) $CO_2 + H_2O$

(c) $CO_2 + CO + H_2O$ (d) $HCOOH + CO$

106. Benzoic acid is less acidic than salicylic acid because of [Bihar MEE 1997]

(a) Hydrogen bond (b) Inductive effect

(c) Resonance (d) All of these

(e) None of these

107. Lactic acid on heating with conc. H_2SO_4 gives [MP PET 1996]

(a) Acetic acid (b) Propionic acid

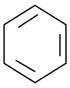
(c) Acrylic acid (d) Formic acid

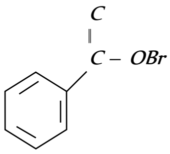
108. Acetamide is [MP PET 1990; RPMT 1999]

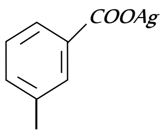
(a) Acidic (b) Basic

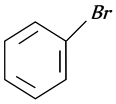
(c) Neutral (d) Amphoteric

109. Silver benzoate reacts with bromine to form [KCET 1996]

(a) 

(b) 

(c) 

(d) 

110. Acetic anhydride reacts with diethyl ether in presence of anhydrous $AlCl_3$ to form [MP PMT 1992]

(a) Ethyl acetate (b) Methyl propionate

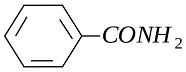
(c) Methyl acetate (d) Propionic acid

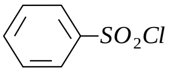
111. Treatment of benzoic acid with $Cl_2 / FeCl_3$ will give [KCET 1998; CET Pune 1998]

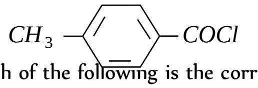
(a) *p*-chlorobenzoic acid (b) *o*-chlorobenzoic acid

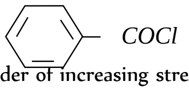
(c) 2, 4-dichlorobenzoic acid (d) *m*-chlorobenzoic aicd

112. Hinsberg's reagent is [MP PMT 2003]

(a) 

(b) 

(c) 

(d) 

113. Which of the following is the correct order of increasing strengths of carboxylic acids

(a) $CH_2FCOOH < CH_3COOH < CH_2ClCOOH < CCl_3COOH$

(b) $CH_3COOH < CH_2ClCOOH < CH_2FCOOH < CCl_3COOH$

(c) $CH_2ClCOOH < CH_2FCOOH < CCl_3COOH < CH_3COOH$

(d) $CCl_3COOH < CH_2ClCOOH < CH_2FCOOH < CH_3COOH$

114. The weakest acid among the following is [CPMT 1976, 82, 89; BHU 1982; CBSE PMT 1991; MP PMT 1989; Roorkee 1992; RPET 1999]

(a) CH_3COOH (b) $Cl_2CHCOOH$

(c) $ClCH_2COOH$ (d) Cl_3CCOOH

115. Consider the acidity of the carboxylic acids

(a) $PhCOOH$ (b) $o-NO_2C_6H_4COOH$

(c) $p-NO_2C_6H_4COOH$ (d) $m-NO_2C_6H_4COOH$

Which of the following order is correct? [AIEEE 2004]

(a) $b > d > a > c$ (b) $b > d > c > a$

(c) $a > b > c > d$ (d) $b > c > d > a$

116. On mixing ethyl acetate with aqueous sodium chloride, the composition of the resultant solution is [AIEEE 2004]

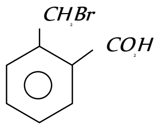
(a) $CH_3COCl + C_2H_5OH + NaOH$

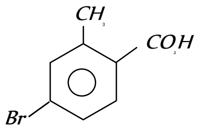
(b) $CH_3COONa + C_2H_5OH$

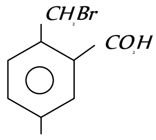
(c) $CH_3COOC_2H_5 + NaCl$

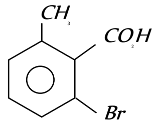
(d) $CH_3Cl + C_2H_5COONa$

117. *o*-Toluic acid on reaction with $Br_2 + Fe$, gives [AIIMS 2004]

(a) 

(b) 

(c) 

(d) 

118. The reaction of an ester $RCOOR'$ with an alcohol $R''OH$ in the presence of an acid gives [Kerala PMT 2004]

(a) $RCOOH$ (b) $R'COOH$

(c) $R''COOR$ (d) $RCOOR''$

(e) $R'COOR''$

119. $RCOOH$ on treatment with PCl_5 and KCN, is subjected to hydrolysis followed by Clemmensen's reduction, the product obtained is [Kerala PMT 2004]

(a) RCH_2-COCl (b) RCH_2-COOH

(c) $RCOCN$ (d) RCN

(e) $R-OH$

120. The reagent which does not give acid chloride on treating with a carboxylic acid is [KCET 2004]

(a) PCl_5 (b) Cl_2

(c) $SOCl_2$ (d) PCl_3

121. An organic compound is boiled with alcoholic potash. The product is cooled and acidified with HCl. A white solid separates out. The starting compound may be [KCET 2004]

(a) Ethyl benzoate (b) Ethyl formate

(c) Ethyl acetate (d) Methyl acetate

122. The OH group of an alcohol or the $-COOH$ group of a carboxylic acid can be replaced by $-Cl$ using [CBSE PMT 2004]

(a) Chlorine

(b) Hydrochloric acid

(c) Phosphorus pentachloride

(d) Hypochlorous acid

123. Which of the following is most acidic [MP PET 2004]

(a) Picric acid (b) *p*-nitrophenol

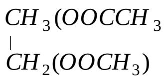
(c) *m*-nitrophenol (d) *o-p* dinitrophenol

124. Benedict's solution is not reduced by [CPMT 2004]

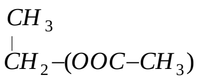
(a) Formaldehyde (b) Acetaldehyde

(c) Glucose (d) Acetic anhydride

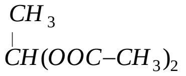
125. CH_3COOH is reacted with $CH \equiv CH$ in presence of Hg^{++}, the product is [DPMT 2004; BHU 1998]

(a) 

$$\begin{array}{l} CH_3(OOCCH_3) \\ | \\ CH_2(OOCH_3) \end{array}$$

(b) 

$$\begin{array}{l} CH_3 \\ | \\ CH_2\text{–}(OOC\text{–}CH_3) \end{array}$$

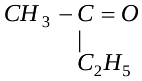
(c) 
$\overset{CH_3}{\overset{|}{C}}H(OOC-CH_3)_2$ (d) None of these

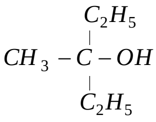
126. Acetic acid reacts with PCl_5 to form **[Pb. CET 2001]**

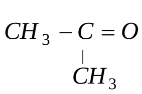
(a) CH_3COCl (b) $CHCl_2COOH$

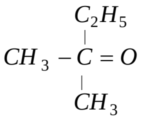
(c) $CH_2ClCOOH$ (d) CH_3COOCl

127. $CH_3COOC_2H_5$ with excess of C_2H_5MgBr and hydrolysis gives **[MH CET 2004]**

(a) 
$CH_3-\underset{C_2H_5}{\underset{|}{C}}=O$

(b) 
$CH_3-\overset{C_2H_5}{\overset{|}{\underset{C_2H_5}{\underset{|}{C}}}}-OH$

(c) 
$CH_3-\underset{CH_3}{\underset{|}{C}}=O$

(d) 
$CH_3-\overset{C_2H_5}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}=O$

128. Urea upon hydrolysis yields **[Pb. CET 2001]**

(a) Acetamide (b) Carbonic acid

(c) Ammonium hydroxide (d) NO_2

129. $CH_3CHO \xrightarrow{HCN} A \xrightarrow{HOH} B$. The product B is **[Pb. CET 2003]**

(a) Malonic acid (b) Glycolic acid

(c) Lactic acid (d) Malic acid

130. What is the % of acetic acid present in vinegar? **[AFMC – 2004; MH CET 2003; CPMT 1974, 75]**

(a) $6-10\%$ (b) $70-80\%$

(c) $7-8\%$ (d) $90-100\%$

131. Fruity smell is given by **[MH CET 2004]**

(a) Esters (b) Alcohols

(c) Chloroform (d) Acid anhydrides

132. Lactic acid molecule has **[MH CET 2004]**

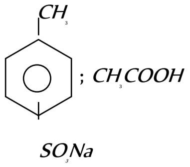
(a) One chiral carbon atom

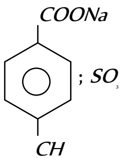
(b) Two chiral carbon atoms

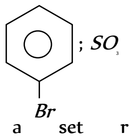
(c) No chiral carbon atom

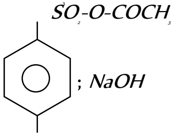
(d) As asymetric molecule

133. 4-methyl benzene sulphonic acid reacts with sodium acetate to give **[IIT-JEE (Screening) 2005]**

(a) 

(b) 

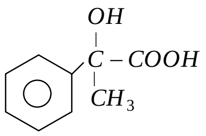
(c) 

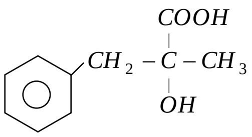
(d) 

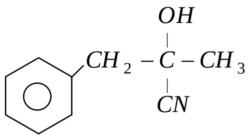
134. In a set reactions acid yielded a product D

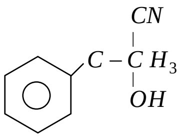
$CH_3COOH \xrightarrow{SOCl_2} A \xrightarrow[Anhr.\,AlCl_3]{Benzene} B \xrightarrow{HCN} C \xrightarrow{HOH} D.$

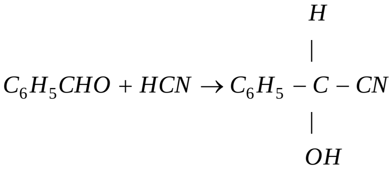
[CBSE PMT 2005]

(a) 

(b) 

(c) 

(d) 

135. 
$C_6H_5CHO + HCN \to C_6H_5-\overset{H}{\overset{|}{\underset{OH}{\underset{|}{C}}}}-CN$

The product would be **[Pb. PMT 1998]**

(a) A racemate

(b) Optically active

(c) A meso compound

(d) A mixture of diastereomers

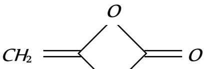
136. What happens when 2-hydroxy benzoic acid is distilled with zinc dust, it gives **[MP PET/PMT 1998]**

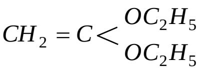
(a) Phenol (b) Benzoic acid

(c) Benzaldehyde (d) A polymeric compound

137. $CH_3CO_2C_2H_5$ on reaction with sodium ethoxide in ethanol gives A, which on heating in the presence of acid gives B compound B is **[AIIMS 2005**

(a) CH_3COCH_2COOH (b) CH_3COCH_3

(c) 

(d) 
$CH_2=C<\begin{matrix}OC_2H_5\\OC_2H_5\end{matrix}$

138. $C_6H_5CONHCH_3$ can be converted into $C_6H_5CH_2NHCH_3$ by**[AIIMS 200**

(a) $NaBH_4$ (b) H_2-Pd/C

(c) $LiAlH_4$ (d) $Zn-Hg/HCl$

139. Among the following acids which has the lowest pKa value **[AIEEE 2005]**

(a) CH_3COOH (b) $HCOOH$

(c) $(CH_3)_2CH-COOH$ (d) CH_3CH_2COOH

140. X is heated with soda lime and gives ethane. X is **[AFMC 2005]**

(a) Ethanoic acid (b) Methanoic acid

(c) Propanoic acid (d) Either (a) or (c)

141. Which of the following is an amphoteric acid **[KCET 2005]**

(a) Glycine (b) Salicylic acid

(c) Benzoic acid (d) Citric acid

142. Colouration of Br_2/CCl_4 will be discharged by **[Orissa JEE 2005]**

(a) Cinnamic acid (b) Benzoic acid

(c) *o*-phthalic acid (d) Acetophenone

143. Order of hydrolysis for the following

(I) $RCOCl$ (II) $RCOOR$

(III) $RCONH_2$ (IV) $(RCO)_2O$ **[DPMT 2005]**

(a) I>IV>II>III (b) I>II>III>IV

(c) I>III>II>IV (d) IV>III>II>I

144. If the enolate ion combines with carbonyl group of ester, we get **[DPMT 2005]**

(a) Aldol (b) α,β-unsaturated ester

(c) β-keto aldehyde (d) Acid

145. Which of the following compounds will react with $NaHCO_3$ solution to give sodium salt and carbon dioxide **[DPMT 2005]**

(a) Acetic acid (b) n-hexanol

(c) Phenol (d) Both (a) and (c)

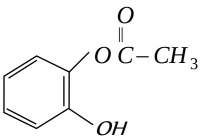
146. A carboxylic acid is converted into its anhydride using **[J & K 2005]**

(a) Thionyl chloride (b) Sulphur chloride

(c) Sulphuric acid (d) Phosphorus pentoxide

Uses of Carboxylic Acids and Their Derivatives

1. The following compound is used as



[KCET 1996]

(a) An anti-inflamatory agent
(b) Analgesic
(c) Hypnotic
(d) Antiseptic

2. To which of the following groups does soap belongs [NCERT 1979; RPET 2000]
(a) Esters
(b) Amines
(c) Salts of organic higher fatty acids
(d) Aldehydes

3. Aspirin is an acetylation product of [CBSE PMT 1998]
(a) *o*-hydroxybenzoic acid (b) *o*-dihydroxybenzene
(c) *m*-hydroxybenzoic acid (d) *p*-dihydroxybenzene

4. Which one is used as a food preservative [MP PET 1989; KCET 1999]
(a) Sodium acetate (b) Sodium propionate
(c) Sodium benzoate (d) Sodium oxalate

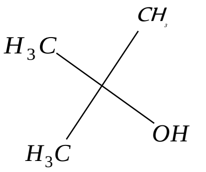
5. What makes a lemon sour [CPMT 1972; CBSE PMT 1991; RPET 1999]
(a) Tartaric acid (b) Oxalic acid
(c) Citric acid (d) Hydrochloric acid

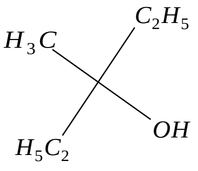
6. The reagent used for protection of amino group during the nitration of aniline is [JIPMER 1997]
(a) $SOCl_2 / Pyridine$ (b) PCl_5
(c) Acetic acid (d) Acetic anhydride

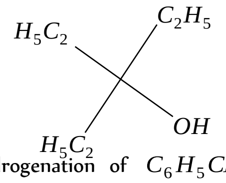
Critical Thinking

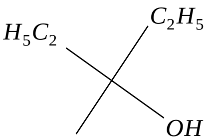
Objective Questions

1. Ethyl ester $\xrightarrow[\text{excess}]{CH_3MgBr} P$. The product P will be [IIT-JEE 2003]

(a)


(b)


(c)


(d)


2. Hydrogenation of $C_6H_5CHOH-COOH$ over $Rh-Al_2O_3$ catalyst in methanol gives [Roorkee Qualifying 1998]
(a) $C_6H_5CH_2COOH$ (b) $C_6H_{11}CHOHCOOH$
(c) $C_6H_5CHOHCH_2OH$ (d) $C_6H_{11}CH_2COOH$

3. Which of the following has the most acidic proton [Roorkee Qualifying 1998]
(a) CH_3COCH_3 (b) $(CH_3)_2C=CH_2$
(c) $CH_3COCH_2COCH_3$ (d) $(CH_3CO)_3CH$

4. In the anion $HCOO^-$ the two carbon-oxygen bonds are found to be of equal length. What is the reason for it
(a) Electronic orbitals of carbon atom are hybridised
(b) The $C=O$ bond is weaker than the $C-O$ bond
(c) The anion $HCOO^-$ has two resonating structures
(d) The anion is obtained by removal of a proton form the acid molecule

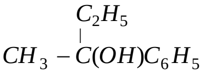
5. An organic compound of molecular formula $C_4H_{10}O$ does not react with sodium. With excess of HI, it gives only one type of alkyl halide. The compound is [SCRA 2001]
(a) Ethoxyethane (b) 2-Methoxypropane
(c) 1-Methoxypropane (d) 1-Butanol

6. When $CH_2=CH-COOH$ is reduced with $LiAlH_4$, the compound obtained will be [AIEEE 2003]
(a) CH_3-CH_2-COOH (b) $CH_2=CH-CH_2OH$
(c) $CH_3-CH_2-CH_2OH$ (d) CH_3-CH_2-CHO

7. In a set of the given reactions, acetic acid yielded a product C

$$CH_3COOH + PCl_5 \rightarrow A \xrightarrow[anh.\,AlCl_3]{C_6H_6} B \xrightarrow[ether]{C_2H_5MgBr} C.$$

Product C would be [CBSE PMT 2003]

(a)

$CH_3-\overset{\overset{C_2H_5}{|}}{C}(OH)C_6H_5$
(b) $CH_3CH(OH)C_2H_5$
(c) $CH_3COC_6H_5$ (d) $CH_3CH(OH)C_6H_5$

8. Carboxylic acids are more acidic than phenol and alcohol because of
(a) Intermolecular hydrogen bonding
(b) Formation of dimers
(c) Highly acidic hydrogen
(d) Resonance stabilization of their conjugate base

9. $R-CH_2-CH_2OH$ can be converted into RCH_2CH_2COOH. The correct sequence of the reagents is [AIIMS 1997]
(a) PBr_3, KCN, H_3O^+ (b) PBr_3, KCN, H_2
(c) HCN, PBr_3, H^+ (d) KCN, H^+

10. When propionic acid is treated with aqueous sodium bicarbonate CO_2 is liberated. The 'C' of CO_2 comes from [IIT-JEE (Screening) 1999]
(a) Methyl group (b) Carboxylic acid group
(c) Methylene group (d) Bicarbonate

11. Benzoyl chloride is prepared from benzoic acid by [IIT-JEE (Screening) 2000]
(a) Cl_2, hv (b) SO_2Cl_2
(c) $SOCl_2$ (d) Cl_2, H_2O

12. Identify the correct order of boiling points of the following compounds

$\underset{(1)}{CH_3CH_2CH_2CH_2OH}$, $\underset{(2)}{CH_3CH_2CH_2CHO}$,
$\underset{(3)}{CH_3CH_2CH_2COOH}$ [IIT-JEE (Screening) 2002]
(a) $1>2>3$ (b) $3>1>2$
(c) $1>3>2$ (d) $3>2>1$

13. The compound not soluble in acetic acid is [UPSEAT 2003; IIT-JEE 1986]
(a) $CaCO_3$ (b) CaO
(c) CaC_2O_4 (d) $Ca(OH)_2$

14. The *ortho/para* directing group among the following is [AIIMS 2003]
(a) $COOH$ (b) CN
(c) $COCH_3$ (d) $NHCOCH_3$

15. Iodoform test is not given by [BHU 1995]
(a) Acetone (b) Ethyl alcohol
(c) Acetic acid (d) None of these

16. How will you convert butan-2-one to propanoic acid [IIT-JEE (Screening) 2005]

(a) Tollen's reagent (b) Fehling's solution

(c) $NaOH / I_2 / H^+$ (d) $NaOH / NaI / H^+$

17. Which of the acids cannot be prepared by Grignard reagent [MH CET 2004]

(a) Acetic acid (b) Succinic acid

(c) Formic acid (d) All of these

Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) *If both assertion and reason are true and the reason is the correct explanation of the assertion.*

(b) *If both assertion and reason are true but reason is not the correct explanation of the assertion.*

(c) *If assertion is true but reason is false.*

(d) *If the assertion and reason both are false.*

(e) *If assertion is false but reason is true.*

1. Assertion : Carboxylic acid exist as dimer.
Reason : Carboxylic acid shows hydrogen bonding.

2. Assertion : Trichloroacetic acid is stronger than acetic acid.
Reason : Electron withdrawing substituents decrease the activity.

3. Assertion : First four aliphatic monocarboxylic acids are colourless.
Reason : Carboxylic acids with more than five carbon atoms are insoluble in water.

4. Assertion : Carboxylic acids do not give characteristic reactions of carbonyl group.
Reason : Carboxylic acids exist as cyclic dimers in solid, liquid and even in vapour state.

5. Assertion : Pure acetic acid is converted into ice like solid called glacial acetic acid.
Reason : Acetic acid is stronger than $HCOOH$.

6. Assertion : The second dissociation constant of maleic acid is greater than fumaric acid.
Reason : Higher the dissociation constant of acid more is acidic character.

7. Assertion : Lower acids on reacting with strong electropositive metals give effervescences of H_2.
Reason : $MeCOOC_4H_9$ hydrolyses rapidly than $MeCOOCH_3$.

8. Assertion : Melting point of carboxylic acids shows a regular pattern.
Reason : Carboxylic acids are reduced to alkanes on reduction with HI in presence of red phosphorus.

9. Assertion : Electron withdrawing groups decrease the acidity of carboxylic acids.
Reason : Substituents affect the stability of the conjugate base and acidity of carboxylic acids.

10. Assertion : Fluoroacetic acid is stronger acid than bromoacetic acid.
Reason : Acidity depends upon the electron withdrawing effects of the fluorine and chlorine.

11. Assertion : Aminoacetic acid is less acidic than acetic acid.
Reason : Amino group is electron donating in nature.

12. Assertion : Carboxylic acids have higher boiling points than alkanes.
Reason : Carboxylic acids are resonance hybrids.

13. Assertion : Both formic acid and oxalic acid decolourize $KMnO_4$ solution.
Reason : Both are easily oxidised to CO_2 and H_2O.

14. Assertion : Esters which contain $\alpha-$hydrogens undergo Claisen condensation.
Reason : $LiAlH_4$ reduction of esters gives acids.

Answers

General Introduction of Carboxylic Acids and Their Derivatives

1	d	2	d	3	c	4	d	5	a
6	c	7	d	8	c	9	c	10	d
11	a	12	c	13	d	14	d	15	b
16	c	17	d	18	d	19	c	20	b,d
21	a	22	a	23	c	24	b	25	b
26	b	27	c	28	d	29	a	30	a
31	c	32	b	33	d	34	c	35	a
36	d	37	a	38	d				

Preparation of Carboxylic Acids and Their Derivatives

1	d	2	a	3	a	4	c	5	c
6	a	7	a	8	c	9	a	10	b
11	d	12	a	13	b	14	d	15	a
16	c	17	c	18	a	19	c	20	b
21	a	22	b	23	b	24	a	25	c
26	d	27	c	28	b	29	a	30	b
31	c	32	a	33	b	34	c	35	a
36	b	37	b	38	c	39	b	40	a
41	d	42	b	43	b	44	a	45	b
46	d	47	c	48	a	49	a		

Properties of Carboxylic Acids and Their Derivatives

1	c	2	b	3	d	4	b	5	d
6	b	7	ad	8	b	9	a	10	a
11	a	12	d	13	b	14	b	15	d
16	b	17	c	18	a	19	d	20	d

21	b	22	b	23	b	24	d	25	c
26	c	27	b	28	c	29	c	30	c
31	b	32	c	33	d	34	c	35	d
36	c	37	d	38	c	39	c	40	c
41	a	42	b	43	d	44	c	45	b
46	b	47	c	48	d	49	c	50	c
51	c	52	b	53	b	54	b	55	d
56	b	57	c	58	a	59	c	60	a
61	c	62	c	63	b	64	c	65	b
66	a	67	c	68	b	69	c	70	a
71	b	72	b	73	c	74	b	75	a
76	d	77	c	78	a	79	c	80	d
81	a	82	a	83	b	84	b	85	b
86	b	87	d	88	d	89	d	90	d
91	d	92	d	93	c	94	b	95	d
96	d	97	b	98	a	99	a	100	a
101	a	102	a	103	a	104	a	105	c
106	a	107	c	108	d	109	d	110	a
111	d	112	b	113	b	114	a	115	d
116	c	117	c	118	d	119	b	120	b
121	a	122	c	123	a	124	d	125	c
126	a	127	b	128	b	129	c	130	a
131	a	132	a	133	a	134	a	135	b
136	b	137	c	138	d	139	b	140	c
141	a	142	a	143	a	144	c	145	a
146	d								

Uses of Carboxylic Acids and Their Derivatives

1	b	2	c	3	a	4	c	5	c
6	d								

Critical Thinking Questions

1	a	2	b	3	d	4	c	5	a
6	b	7	a	8	d	9	a	10	d
11	c	12	b	13	c	14	d	15	c
16	c	17	c						

Assertion & Reason

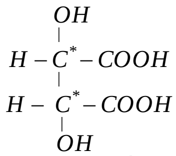
1	a	2	c	3	c	4	b	5	c
6	e	7	c	8	e	9	e	10	a
11	c	12	b	13	a	14	c		

Answers and Solutions

General Introduction of Carboxylic Acids and Their Derivatives

1. (d) Methyl salicylate occurs in natural essential oils like winter green.

2. (d) Tartaric acid have the chiral carbon (*) atom. So it is optically active.



$$\begin{array}{c} OH \\ | \\ H-C^{*}-COOH \\ | \\ H-C^{*}-COOH \\ | \\ OH \end{array}$$

Tartaricacid

3. (c) Formula of palmitic acid is $C_{15}H_{31}COOH$.

4. (d) Amide group represent by the formula $-CONH_2$

5. (a) $\underset{3}{Cl-CH_2}-\underset{2}{CH_2}-\underset{1}{COOH}$

3 chloro propanoic acid

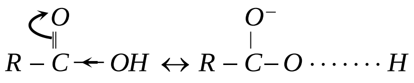
7. (d) Soaps are sodium salt of fatty acids *e.g.*- $C_{17}H_{35}COONa$ Sodium Steariate acid.

8. (c) $\underset{\text{Primary amide}}{R-CONH_2}$ $\underset{\text{Secondary amide}}{(RCO)_2NH}$

9. (c)

$\begin{array}{l}CHOHCOOH\\ |\\ CHOHCOOH\end{array}$ is known as tartaric acid and its potassium salt is known as Tartaremetic.

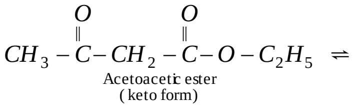
11. (a)



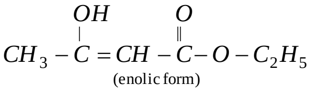
$$R-\overset{\overset{O}{\|}}{C}\leftarrow OH \leftrightarrow R-\overset{\overset{O^-}{|}}{C}-O\cdots\cdots H$$

It represent the acidic nature.

12. (c)



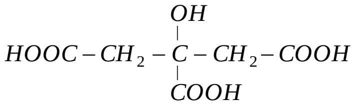
$$\underset{\substack{\text{Acetoacetic ester}\\ \text{(keto form)}}}{CH_3-\overset{\overset{O}{\|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-O-C_2H_5} \rightleftharpoons$$



$$\underset{\text{(enolic form)}}{CH_3-\overset{\overset{OH}{|}}{C}=CH-\overset{\overset{O}{\|}}{C}-O-C_2H_5}$$

13. (d) $2RCOOH \xrightarrow{-H_2O} \underset{\text{Acidanhydride}}{(RCO)_2O}$

14. (d)

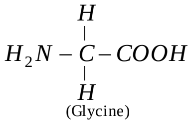


$$HOOC-CH_2-\overset{\overset{OH}{|}}{\underset{\underset{COOH}{|}}{C}}-CH_2-COOH$$

It is citric acid consist three carboxylic group.

16. (c) Wax are long chain ester.

17. (d) Glycine do not have the chiral carbon so it is not optically active acid.



$$H_2N-\overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}}-COOH$$

(Glycine)

18. (d) Except phenyl acetic acid all rest acid are fatty acid.

19. (c) Vinegar contain 8-10% acetic acid.

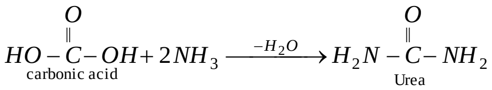
20. (b,d) General formula of monocarboxylic acid is $C_nH_{2n+1}COOH$ or $C_nH_{2n}O_2$.

21. (a) Formula of Acetamide is CH_3CONH_2 which consist single oxygen atom.

22. (a) Urea behaves as a monoacidic base and react with nitric acid and form sparingly soluble nitrate.

23. (c) Fats and oil jointly known as lipid which are the ester of glycerol with high fatty acid.

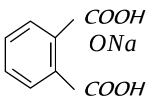
26. (b) Urea is the diamide of carbonic acid.



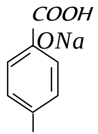
$$\underset{\text{carbonic acid}}{HO-\overset{\overset{O}{\|}}{C}-OH}+2NH_3 \xrightarrow{-H_2O} \underset{\text{Urea}}{H_2N-\overset{\overset{O}{\|}}{C}-NH_2}$$

So two mole of NH_3 required that why it is the diamide of carbonic acid.

27. (c) Phthalic acid is the isomer of 1, 4 benzene dicarboxylic acid because both have the same molecular formula but differ in their structure.



Phthalic acidONa



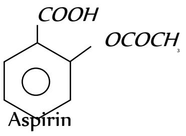
1, 4 benzene dicarboxylic acidONa

28. (d) Esters are $RCOOR'$, where OR' = alkoxy group and $R = H$ or alkyl or aryl group.

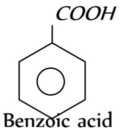
29. (a) Soaps are the sodium or potassium salts of higher fatty acids.

33. (d) Vinegar is the diluted solution of acetic acid (CH_3COOH). It is formed by the fermentation of ethyl alcohol in the presence of enzyme acetobacter.

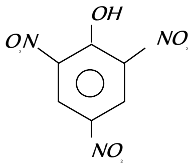
34. (c)



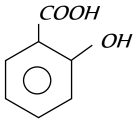
Aspirin



Benzoic acid



Picric acid



Salicylic acid

35. (a) Acetic acid is the chief constituent of vinegar and hence its name (Latin : acetum = vinegar).

36. (b) Phenol was discovered by Runge in the middle oil fraction of coal-tar distillation and named it ‘carbolic acid’ (carbo-coil, oleum = oil) or phenol containing 5% water in liquid at room temperature and it is termed as carbolic acid.

37. (a) Any electron withdrawing substituent (having-I-effect) stabilises the anion by dispersing the negative charge and therefore, increases the acidity. Chlorine is an electron withdrawing group.

38 (d) The order of reactivity of acid derivatives towards different reactions decreases in the order,

$$RCOCl > (RCO)_2O > RCOOR' > RCONH_2$$

In other words, the reactivity decreases as the basicity of the leaving group increases i.e.,

$$Cl^- < RCOO^- < RO^- < NH_2^-$$

Preparation of Carboxylic Acids and Their Derivatives

1. (d) $CH_3CH_2NO_2 + H_2O \xrightarrow{H_2SO_4}$

$$CH_3COOH + NH_2OH$$

2. (a) $\underset{\text{Formic acid}}{HCOOH} + PCl_5 \rightarrow \underset{\text{Formyl chloride}}{HCOCl} + POCl_3 + HCl$

4. (c) $2CH_3CHO \xrightarrow{Al(OC_2H_5)_3} CH_3CH_2OH$

$$+CH_3COOH \rightarrow \underset{\text{Ethylacetate}}{CH_3COOC_2H_5} + H_2O$$

5. (c) $CH_3CHO \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3COOH$

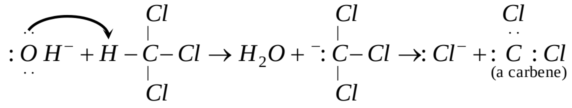
6. (a) $C_2H_5OH \xrightarrow{\text{Acetobacter}} CH_3COOH$

7. (a) $CO + NaOH \xrightarrow{\Delta} HCOONa$

9. (a) $CH \equiv CH \xrightarrow[H_2SO_4]{1\% Hg^{+2}} \underset{\text{Unstable}}{CH_3-CH\Big\langle\begin{matrix}OH\\OH\end{matrix}}$

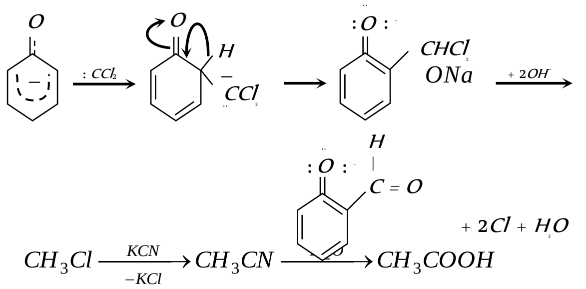
$$\rightarrow CH_3CHO \xrightarrow{[O]} \underset{\text{acetic acid}}{CH_3COOH}$$

10. (b) Reimer-Tiemann reaction involves a carbene intermediate.



$$:\ddot{O}H^- + H-\underset{Cl}{\overset{Cl}{\underset{|}{\overset{|}{C}}}}-Cl \rightarrow H_2O + {}^-:\underset{Cl}{\overset{Cl}{\underset{|}{\overset{|}{C}}}}-Cl \rightarrow :Cl^- + :\overset{Cl}{\ddot{C}}:Cl$$

(a carbene)



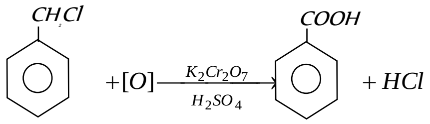
11. (d) $CH_3Cl \xrightarrow[-KCl]{KCN} CH_3CN \xrightarrow{H_2O} CH_3COOH$

$$\xrightarrow{NH_3} CH_3COONH_4 \xrightarrow{\Delta} CH_3CONH_2$$

12. (a) $CH_3CN \xrightarrow{H_2O} CH_3COOH + NH_3$

13. (b) $C_6H_5CH_2OH + [O] \xrightarrow{KMnO_4} C_6H_5COOH + H_2O$

14. (d)



15. (a) $\begin{matrix}CH_3\\CH_3\end{matrix}\Big> C = O \xrightarrow[(HCl)]{NaCN} \underset{(A)}{\begin{matrix}CH_3\\CH_3\end{matrix}\Big> C \Big\langle \begin{matrix}OH\\CN\end{matrix}}$

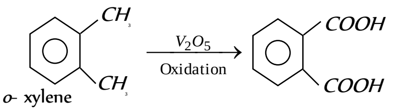
$$\xrightarrow[\Delta]{H_3^+O} \underset{(B)}{\begin{matrix}CH_3\\CH_3\end{matrix}\Big> C \Big\langle \begin{matrix}OH\\COOH\end{matrix}}$$

16. (c) $\begin{matrix}CH_3COOH\\CH_3COOH\end{matrix} + P_2O_5 \rightarrow \begin{matrix}CH_3-CO\\CH_3-CO\end{matrix}\Big> O + H_2O$

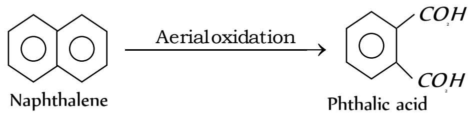
17. (c) $\begin{matrix}COOH\\|\\COOH\end{matrix} \xrightarrow[\text{Decarboxylation}]{\text{Glycerol},110°C} HCOOH + CO_2$

18. (a) $CH_3COOH + CHCl_3 \rightarrow \text{No reaction}$

19. (c)



21. (a)



22. (b) $C_6H_5MgBr \xrightarrow[(ii)H_3^+O]{(i)CO_2} \underset{(P)}{C_6H_5COOH}$

23. (b) Acetic acid freezes at $16.6°C$ while water freezes at $0°C$. So glacial acetic acid is obtained by crystallizing, separating and melting acetic acid.

25. (c) $C_2H_5OH + CH_3COOH \xrightarrow[H_2SO_4]{\text{Conc}} CH_3COOC_2H_5$

It is called esterification reaction.

26. (d) $\underset{\text{Ammonium chloride}}{2NH_4Cl} + \underset{\text{Potassium Cyanate}}{KCNO} \rightarrow \underset{\text{Urea}}{NH_2-CO-NH_2} + KCl$

28. (b) $RCOOH + C_2H_5OH \xrightarrow[HCl]{\text{dry}} RCOOC_2H_5 + H_2O$

29. (a) $CO_2 + C_3H_7MgBr \xrightarrow{\text{Hydrolysis}}$

$$\underset{\text{Butanoic acid}}{C_3H_7COOH} + Mg\Big\langle\begin{matrix}Br\\OH\end{matrix}$$

31. (c) $CH_3-COO\underline{Na} + CH_3-CO-\underline{Cl} \rightarrow \underset{\text{Aceticanhydride}}{CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3} + NaCl$

32. (a) $\underset{\text{Acetamide}}{CH_3-CO-NH_2} \xrightarrow[H_2O]{\text{Hydrolysis}} \underset{\text{Aceticacid}}{CH_3COOH} + NH_3$

33. (b) $CH_3MgI + \underset{\text{Ethylchloroformate}}{Cl-\overset{O}{\overset{\|}{C}}-OC_2H_5} \rightarrow \left[Cl-\underset{CH_3}{\underset{|}{\overset{OMgI}{\overset{|}{C}}}}-OC_2H_5\right]$

$$\rightarrow \underset{\text{Ethylacetate}}{CH_3-\overset{O}{\overset{\|}{C}}-OC_2H_5} + Mg\Big\langle\begin{matrix}Br\\I\end{matrix}$$

34. (c) $\underset{\text{Sodium acetate}}{CH_3COONa} + \underset{\text{Acetyl chloride}}{CH_3COCl} \rightarrow NaCl + \underset{\text{Acetic anhydride}}{CH_3COOCOCH_3}$

35. (a) $\underset{\text{Ammonium acetate}}{CH_3COONH_4} + CH_3COOH \xrightarrow{110°C}$

$$\underset{\text{Acetamide}}{CH_3CONH_2} + H_2O$$

36. (b) $2RCHO \xrightarrow{Al(OC_2H_5)_3} CH_3-\overset{O}{\overset{\|}{C}}-O-CH_2-CH_3$

37. (b) $RCOOAg + R'I \rightarrow \underset{\text{ester}}{RCOOR'} + AgI$

38. (c) When Cl_2 or Br_2 is react with carboxylic acid in the presence of red phosphorus then α-hydrogen of carboxylic acid is replaced by Cl_2 or Br_2

$$\underset{\text{Aceticacid}}{CH_3COOH} \xrightarrow{Br_2} \underset{\alpha-\text{bromo acetic acid}}{CH_2BrCOOH}$$

This reaction is known as Hell Volhard Zelinsky reaction.

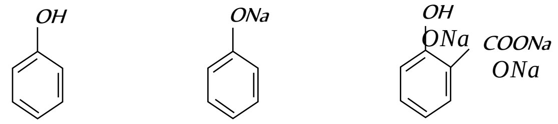
39. (b) Tertiary alcohol are not oxidised easily but on drastic conditions, these oxidise to give first ketone and then acid by losing one carbon at each step

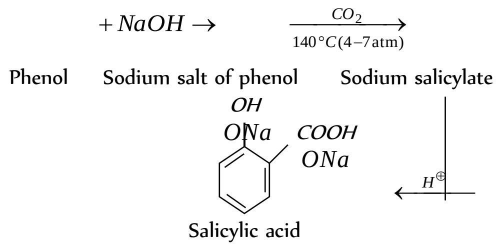
$$\begin{matrix}R\\R\\R\end{matrix}\Big> C-OH \xrightarrow{[O]} \begin{matrix}R\\R\end{matrix}\Big> C=O \xrightarrow{[O]} R.COOH$$

40. (a) When succinic acid is heated it forms. Succinic anhydride

$$\underset{\text{Succinic acid}}{\begin{matrix}CH_2COOH\\|\\CH_2COOH\end{matrix}} \xrightarrow[-H_2O]{\Delta} \underset{\text{Succinic anhydride}}{\begin{matrix}CH_2CO\\|\\CH_2CO\end{matrix}\Big> O}$$

41. (d) Treatment of sodium salt of phenol with CO_2 under pressure bring about substitution of the carbonyl group $-COOH$, for the hydrogen of the ring. This is called as Kolbe's reaction



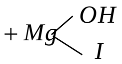


42. (b) When an acyl halide is heated with acid salt, anhydrides are formed

$$CH_3COONa + CH_3COCl \xrightarrow{\Delta} \underset{\text{acetic anhydride}}{(CH_3CO)_2O} + NaCl$$

43. (b) CO_2 adds to Grignard's reagent to yield acids.

$$CO_2 \xrightarrow{CH_3MgI} CH_3COOMgI \xrightarrow{H.OH} CH_3COOH$$



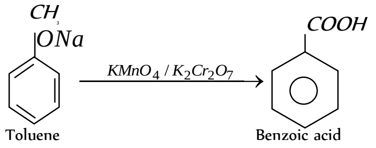
$$+ Mg\begin{matrix} OH \\ I \end{matrix}$$

44. (a) Amide, on treating with HNO_2, give acids.

$$CH_3CONH_2 \xrightarrow[(HNO_2)]{NaNO_2/HCl} \underset{\text{acetic acid}}{CH_3COOH} + N_2 + H_2O$$

45. (b) Aldehydes are easily oxidised to carboxylic acids on treatment with common oxidising agents like nitric acid, potassium permanganate and dichromate etc.

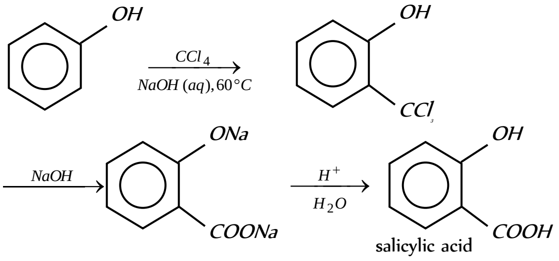
46. (d)



47. (c) This is an example of Perkin's reaction.

Therefore, (*X*) is Acetic anhydride.

48. (a)



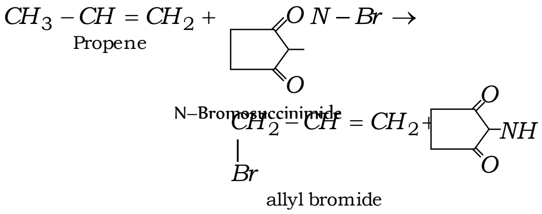
The above given reaction is known as Reimer- Tiemann reaction.

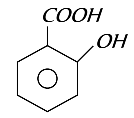
49. (a) $C_2H_5OH \xrightarrow{[O]} CH_3COOH$.

Properties of carboxylic acids and Their derivatives

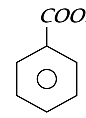
1. (c) $BrCH_2CH_2COOH$ is least acidic or has less K_a *i.e.*, dissociation constant. It is (*a*) due to lesser –I effect of *Br* than *F* and (*b*) *Br* atom further away form $-COOH$ group.

2. (b)





Salicylic acid



Benzoic acid

3. (d) $\xrightarrow{Zn\ Pdr}$

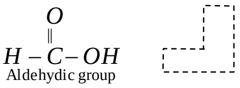
4. (b) $2CH_3COOH \xrightarrow[573\,K]{MnO} CH_3COCH_3 + CO_2 + H_2O$

5. (d) Presence of $-I$ effect chlorine atom increases the acidic nature by withdrawing electrons

$$\underset{\substack{\text{Trichloroacetic}\\\text{acid (Most acidic)}}}{Cl_3CCOOH} > \underset{\text{Dichloro acetic acid}}{Cl_2CHCOOH} > \underset{\text{Monochloro acetic acid}}{Cl-CH_2-COOH} > \underset{\substack{\text{Acetic acid}\\\text{(Least acidic)}}}{CH_3COOH}$$

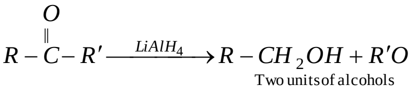
8. (b) The reaction of acetamide with water is an example of hydrolysis.

9. (a) Methanoic acid resemble with aldehyde due to its structure. So it reduce fehling reagent.



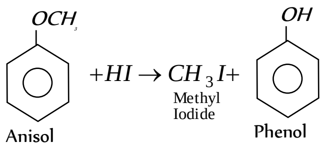
$$\underset{\text{Aldehydic group}}{H-\overset{\overset{\displaystyle O}{\|}}{C}-OH}$$

11. (a)



$$R-\overset{\overset{\displaystyle O}{\|}}{C}-R' \xrightarrow{LiAlH_4} \underset{\text{Two units of alcohols}}{R-CH_2OH + R'OH}$$

12. (d)



13. (b) $CH_3COOH + CH_3-Mg-X \rightarrow CH_3-CH_3$

14. (b) Forms *H*-bonding by means two highly electronegative atoms present in it.

15. (d) $\underset{\text{Propionamide}}{CH_3CH_2CONH_2} \xrightarrow[\text{Hofmann bromamide reaction}]{Br_2/KOH} \underset{\text{Ethylamine}}{CH_3CH_2NH_2}$

16. (b) $\underset{\text{Methylethanoate}}{CH_3COOCH_3} \xrightarrow[-CH_3OH]{NaOH} \underset{\text{Sodium acetate}}{CH_3COONa}$

$$CH_3-CH_3 \xleftarrow[-CO_2,\,-NaOH,\,-H_2]{\text{Kolbe's electrolysis}}$$

17. (c) $\underset{\text{Ammonium cyanate}}{NH_4CNO} \xrightarrow{\Delta} \underset{\text{Urea}}{NH_2-CO-NH_2}$

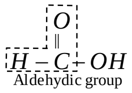
$$NH_2-CO-NH_2 + \underset{\text{Urea}}{H-NH-CO-NH_2} \xrightarrow[-NH_3]{\Delta}$$

$$\underset{\text{Biuret}}{NH_2-CO-NH-CO-NH_2}$$

19. (d) $F-CH_2-COOH > Cl-CH_2-COOH >$

$$Br-CH_2-COOH > CH_3COOH$$

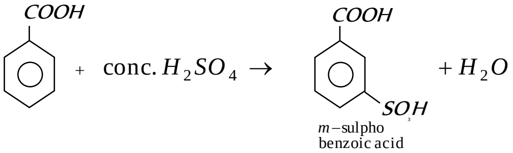
20. (d) Formic acid resemble with aldehyde due to its structure so it reduce Tollen's reagent.



$$\underset{\text{Aldehydic group}}{H-\overset{\overset{\displaystyle O}{\|}}{C}-OH}$$

22. (b) $HCOOH \xrightarrow{conc.\,H_2SO_4} CO + H_2O$

23. (b)



24. (d) CHF_2-COOH. Difluoroacetic acid is strongest because presence of two F atoms increases its acidic nature.

25. (c) CH_3COOH does not give silver mirror test.

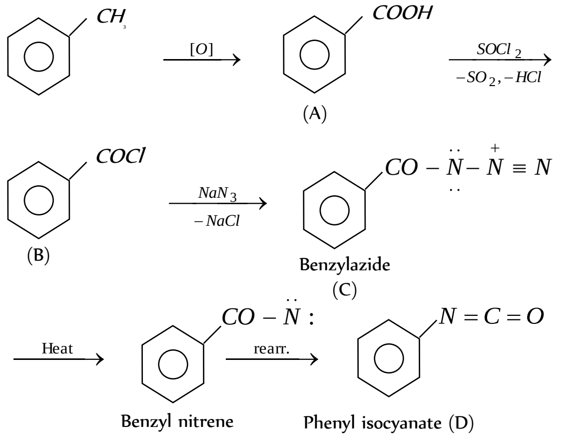
26. (c) $2CH_3COOH \xrightarrow[300^oC]{MnO} \underset{\text{Acetone}}{CH_3COCH_3} + CO_2 + H_2O$

27. (b) CH_3COOH is slightly ionised than H_2SO_4.

28. (c) Presence of methyl group decreases the acidic character of acetic acid due to positive inductive effect $(+I)$.

29. (c) $\begin{matrix} CH_3CO \\ CH_3CO \end{matrix}\!\!>O + 2NH_3 \rightarrow \underset{\text{Acetamide}}{CH_3CONH_2} + \underset{\text{Ammonium acetate}}{CH_3COONH_4}$

30. (c)



32. (c) $CH_3COOH \xrightarrow{LiAlH_4} CH_3CH_2OH$

$CH_3CH_2OH \xrightarrow{I_2/NaOH} CHI_3 \xrightarrow{Ag} C_2H_2$

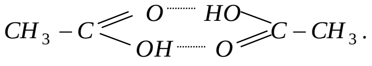
34. (c) $HCOOH + 2Cu^{+2} \xrightarrow[\text{Solution}]{\text{Fehling}} \underset{\text{Red ppt}}{Cu_2O} + H_2O + CO_2$

Whereas $CH_3COOH \xrightarrow[\text{Solution}]{\text{Fehling}}$ No reaction

35. (d) $HCOOH + NaHCO_3 \rightarrow HCOONa + H_2O + CO_2$

$HCHO + NaHCO_3 \rightarrow$ No reaction

37. (d)



$CH_3-C\begin{matrix} \nearrow\!\!\!\!= O \cdots\cdots HO \\ \searrow OH \cdots\cdots O \end{matrix}\!\!\begin{matrix} \searrow \\ \nearrow\!\!\!\!= \end{matrix} C-CH_3$.

Due to H-bonding

38. (c) $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$

39. (c) Acetic acid forms dimer in benzene due to which molecular mass becomes doubles.

42. (b) $CH_3COOH \xrightarrow{I_2/\text{Red } p} CH_2Cl-COOH$

44. (c) $CH_3COOH \xrightarrow{\Delta/P_2O_5} (CH_3CO)_2O$

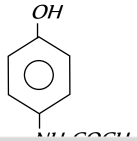
47. (c) $\begin{matrix} COOH \\ | \\ COOH \end{matrix} + KMnO_4 + H_2SO_4 \rightarrow 2CO_2 + H_2O$

$+K_2SO_4 + MnSO_4$

49. (c) $R-X \xrightarrow{KCN} R-CN \xrightarrow[H_2O]{NaOH} R-COONa + NH_3$

50. (c) $CH_3CH_2COOH \xrightarrow{Cl_2/Fe} CH_3-\underset{\underset{Cl}{|}}{CH}-COOH$

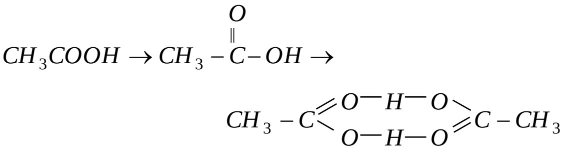
$CH_2=CH-COOH \xleftarrow[KOH]{Alcohol}$



52. (b) N-acetyl paraamino phenol

53. (b) Because it does not have α-hydrogen atom.

54. (b) Molecular Mass increases due to dimer formation

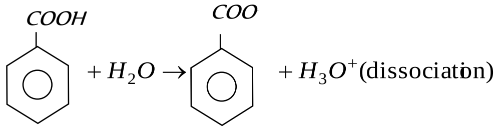


$CH_3COOH \rightarrow CH_3-\overset{\overset{O}{||}}{C}-OH \rightarrow$

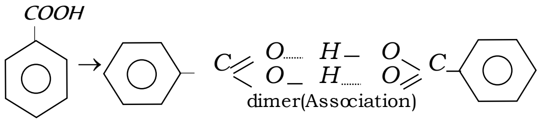
$CH_3-C\begin{matrix} \nearrow\!\!\!\!= O-H-O \\ \searrow O-H-O \end{matrix}\!\!\begin{matrix} \searrow \\ \nearrow\!\!\!\!= \end{matrix} C-CH_3$

Dimer is formed

55. (d)



In benzene solution



57. (c) $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$

$2CH_3COOH + 2Na \rightarrow 2CH_3COONa + H_2$

59. (c) $CH_3-CH_2-CCl_2-COOH$; α,α-dichloro butanoic acid is most acidic. Hence it will easily loose H^+ ions in solution.

62. (c) $CH_3COOH \xrightarrow{NH_3} CH_3CONH_2 \xrightarrow[P_2O_5]{\Delta} CH_3-C\equiv N$

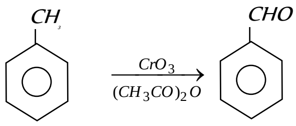
63. (b) $CH_3COOH \xrightarrow{LiAlH_4} CH_3CH_2OH$

64. (c) $\underset{\text{Acetamide}}{CH_3CONH_2} + NaOH \xrightarrow{\text{Boil}} CH_3COONa + NH_3$

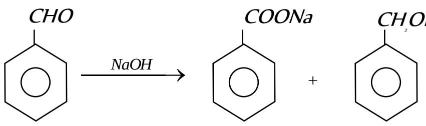
65. (b) $CH_2=CH-(CH_2)_5COOH \xrightarrow[HBr]{\text{Peroxide}}$

$\underset{\underset{Br}{|}}{CH_2}-(CH_2)_6-COOH$

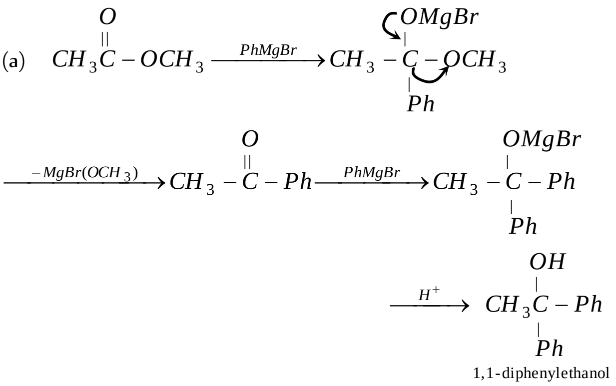
69. (c)



(Etard's reaction)



70. (a)



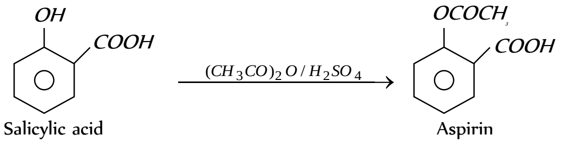
$CH_3\overset{\overset{O}{||}}{C}-OCH_3 \xrightarrow{PhMgBr} CH_3-\overset{\overset{OMgBr}{|}}{\underset{\underset{Ph}{|}}{C}}-OCH_3$

$\xrightarrow{-MgBr(OCH_3)} CH_3-\overset{\overset{O}{||}}{C}-Ph \xrightarrow{PhMgBr} CH_3-\overset{\overset{OMgBr}{|}}{\underset{\underset{Ph}{|}}{C}}-Ph$

$\xrightarrow{H^+} CH_3\overset{\overset{OH}{|}}{\underset{\underset{Ph}{|}}{C}}-Ph$

1,1-diphenylethanol

72. (b) $2NH_2CONH_2 \rightarrow NH_2CONHCONH_2 + NH_3$

74. (b) 

75. (a) $\underset{\text{Acid}}{CH_3COOH} + PCl_5 \rightarrow \underset{\text{Acid chloride}}{CH_3COCl} + POCl_3 + HCl$

77. (c) Alcohols react with acids to form esters which have fruity smell.

78. (a) Acidity decreases with the decrease in electronegativity of halogen *i.e.*,

$$FCH_2COOH > ClCH_2COOH > BrCH_2COOH$$

79. (c) $CH_3CONH_2 \xrightarrow[\text{Hofmann bromamide reaction}]{NaOBr} CH_3NH_2$

80. (d) Formic acid, $HCOOH$ shows reducing property.

81. (a) $HCOOH$ reduces ammoniacal silvernitrate solution, *i.e.*, Tollen's reagent but acetic acid does not.

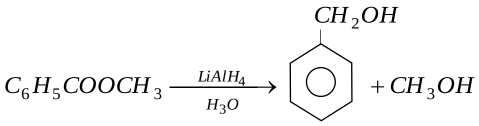
85. (b) $\underset{\text{Ethylbenzoate}}{C_6H_5COOC_2H_5} + NaOH \xrightarrow{\Delta}$

$$\underset{\text{Sod. benzoate}}{C_6H_5COONa} + \underset{\text{Ethanol}}{C_2H_5OH}$$

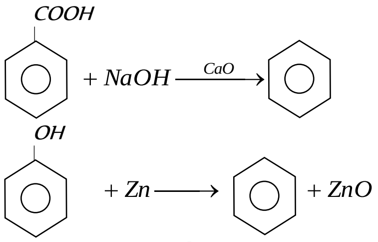
86. (b) $\underset{\text{Lacticacid}}{CH_3 - CHOH - COOH} + [O] \xrightarrow{KMnO_4}$

$$\underset{\text{Pyruvic acid}}{CH_3 - CO - COOH} + H_2O$$

87. (d) $RCOOH \xrightarrow{LiAlH_4} RCH_2OH$

90. (d) 

$C_6H_5COOCH_3 \xrightarrow[H_3O]{LiAlH_4}$ $+ CH_3OH$

92. (d) 

93. (c) $3CH_3COOH + PCl_3 \rightarrow H_3PO_3 + 3CH_3COCl$

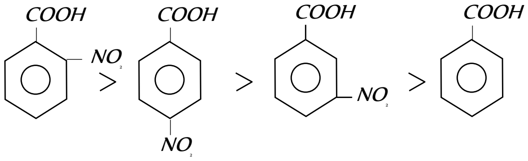
94. (b) $CH_3COCl \xrightarrow{LiAlH_4} CH_3CH_2OH + HCl$

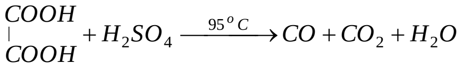
98. (a) $CH_3 - CO - NH_2 \xrightarrow{P_2O_5} CH_3 - C \equiv N + H_2O$

99. (a) In this reaction α-H is replaced by chlorine.

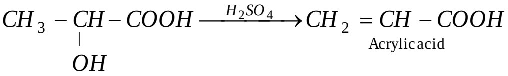
100. (a) Urea are neutral in nature in aqueous solution.

102. (a) $CH_3COOH + 4H \xrightarrow{LiAlH_4} CH_3CH_2 - OH$

103. (a) 

105. (c) 
$\begin{matrix}COOH\\|\\COOH\end{matrix} + H_2SO_4 \xrightarrow{95^oC} CO + CO_2 + H_2O$

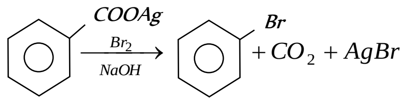
106. (a) Due to intramolecular hydrogen bonding.

107. (c) 
$CH_3 - \underset{OH}{\underset{|}{CH}} - COOH \xrightarrow{H_2SO_4} \underset{\text{Acrylicacid}}{CH_2 = CH - COOH}$

108. (d) Acetamide can behave as weak acid as well as base.

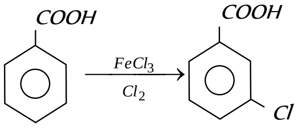
$$CH_3 - CO - NH_2 + HCl \rightarrow \underset{\text{Acetamidehydrogen chloride}}{CH_3CONH_3^+Cl^-}$$

$$2CH_3CONH_2 + HgO \rightarrow \underset{\text{Mercuricacetamide}}{(CH_3CONH)_2Hg} + H_2O$$

109. (d) 

110. (a) $>$ $\begin{matrix}CH_3CO\\CH_3CO\end{matrix} \xrightarrow[AlCl_3]{anhyd.} O + C_2H_5OC_2H_5$

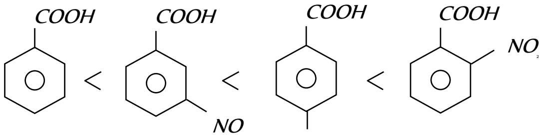
$\underset{\text{Ethylacetate}}{2CH_3COOC_2H_5}$

111. (d) 

112. (b) Benzene sulphonyl chloride is called Hinsberg's reagent.

114. (a) $CH_3COOH < ClCH_2COOH < Cl_2CHCOOH < Cl_3CCOOH$

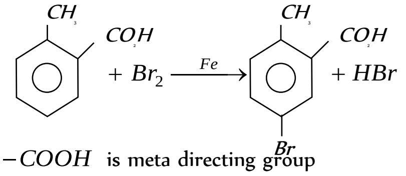
Increasing order of acidic nature.

115. (d) 

Electron withdrawing group, increases the acidity of benzoic acid, *O*-isomer will have higher acidity then corresponding *m* and *p*-isomer due to ortho effect.

116. (c) $CH_3COOC_2H_5 + NaCl_{(aq)} \rightarrow$ no reaction

$$(CH_3COOC_2H_5 + NaCl_{(aq)})$$

117. (c) 

$-COOH$ is meta directing group

118. (d) $R - COOR' + R''OH \overset{H^\oplus}{\rightleftharpoons} RCOOR'' + R'OH$

The exchange of alcohol residue known as alcoholysis or trans esterification

119. (b) $RCOOH + PCl_5 \rightarrow RCOCl + POCl_3 + HCl \xrightarrow{KCN}$

$$RCOCN + KCl \xrightarrow{2H_2O} RCOCOOH + 2NH_3$$

$$\xrightarrow[Zn-Hg\,/\,Conc.\ HCl]{\text{Clemenson reduction}} RCH_2COOH + H_2O$$

120. (b) $CH_3COOH + Cl_2 \rightarrow CH_2Cl\,COOH + HCl$

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

$CH_3COOH + SOCl_2 \rightarrow CH_3COCl + SO_2 + HCl$

$3CH_3COOH + PCl_3 \rightarrow 3CH_3COCl + H_3PO_3$

121. (a) $C_6H_5COOC_2H_5 + KOH(alc) \rightarrow C_6H_5COOK +$

$$C_2H_5OH \xrightarrow{HCl} C_6H_5COOH + KCl$$

122. (c) $ROH + PCl_5 \rightarrow R - Cl + POCl_3 + HCl$

$RCOOH + PCl_5 \rightarrow RCOCl + POCl_3 + HCl$

123. (a) It is picric acid because it has three $-NO_2$ group are arranged which are ortho and para position

124. (d) Benedict solution is readily reduced by aldehyde. It does not oxidise anhydrides

125. (c) $CH \equiv CH + CH_3COOH \xrightarrow{[Hg^{2+}]}$

$$\underset{\text{Vinylacetate}}{H_2C = CH - OCOCH_3} \xrightarrow{CH_3COOH}$$

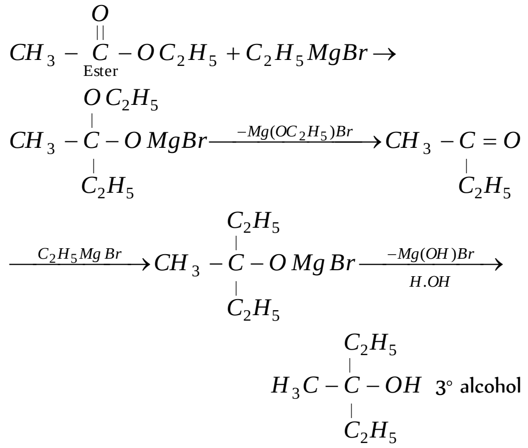
$$\underset{\text{Ethylideneacetate}}{CH_3 - CH(O - COCH_3)_2}$$

This reaction is an example of addition reaction.

126. (a) When acetic acid is reacted with PCl_5 the product formed are acetyl chloride, phosphoryl chloride and hydrochloric acid

$$\underset{\text{Aceticacid}}{CH_3COOH} + \underset{\substack{\text{Phosphorus}\\ \text{Penta chloride}}}{PCl_5} \rightarrow \underset{\substack{\text{Acetyl}\\ \text{Chloride}}}{CH_3COCl} + \underset{\substack{\text{Hydro –}\\ \text{Chloric}\\ \text{acid}}}{HCl} + \underset{\substack{\text{Phosphoryl}\\ \text{chloride}}}{POCl_3}$$

127. (b)



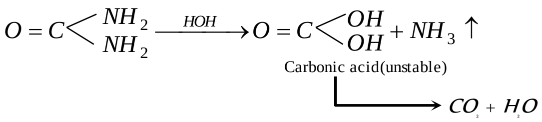
$$\underset{\text{Ester}}{CH_3 - \overset{\overset{O}{||}}{C} - OC_2H_5} + C_2H_5MgBr \rightarrow$$

$$CH_3 - \underset{\underset{C_2H_5}{|}}{\overset{\overset{OC_2H_5}{|}}{C}} - O\,MgBr \xrightarrow{-Mg(OC_2H_5)Br} CH_3 - \underset{\underset{C_2H_5}{|}}{C} = O$$

$$\xrightarrow{C_2H_5Mg\,Br} CH_3 - \underset{\underset{C_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}} - O\,Mg\,Br \xrightarrow[H.OH]{-Mg(OH)Br}$$

$$H_3C - \underset{\underset{C_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}} - OH \text{ 3° alcohol}$$

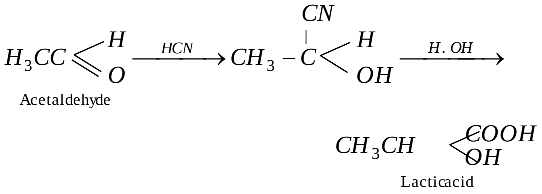
128. (b)



$$O = C\begin{matrix} NH_2 \\ NH_2 \end{matrix} \xrightarrow{HOH} \underset{\text{Carbonic acid(unstable)}}{O = C\begin{matrix} OH \\ OH \end{matrix}} + NH_3 \uparrow$$

$$\longrightarrow CO_2 + H_2O$$

129. (c)



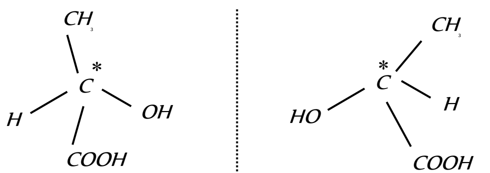
$$\underset{\text{Acetaldehyde}}{H_3CC\begin{matrix} H \\ O \end{matrix}} \xrightarrow{HCN} CH_3 - \overset{\overset{CN}{|}}{C}\begin{matrix} H \\ OH \end{matrix} \xrightarrow{H.OH}$$

$$\underset{\text{Lacticacid}}{CH_3CH\begin{matrix} COOH \\ OH \end{matrix}}$$

130. (a) Vinegar is 6 – 10% aqueous solution of acetic acid

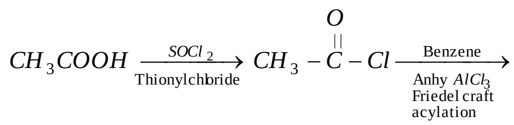
131. (a) All esters are pleasant liquid having pleasant fruity smell. Many of them are used in perfurmery, e.g. Benzyl acetate etc.

132. (a) Lactic acid has one asymmetric (chiral) carbon atom, hence it has $(2' = 2)$ optical isomers.

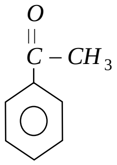


133. (a) 4-methyl benzene sulphonic acid is stronger than acetic acid thus it will release acetic acid from sodium acetate.

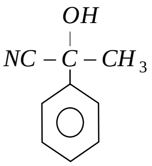
134. (a)



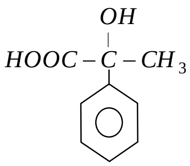
$$CH_3COOH \xrightarrow[\text{Thionylchloride}]{SOCl_2} CH_3 - \overset{\overset{O}{||}}{C} - Cl \xrightarrow[\substack{\text{Anhy } AlCl_3\\ \text{Friedel craft}\\ \text{acylation}}]{\text{Benzene}}$$



(B)



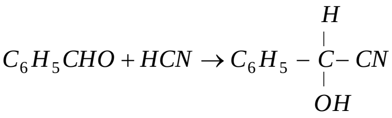
(C)



(D)

$$\xrightarrow[\text{nucleophilic addition}]{H^+CN^-} \qquad \xrightarrow{H_2O}$$

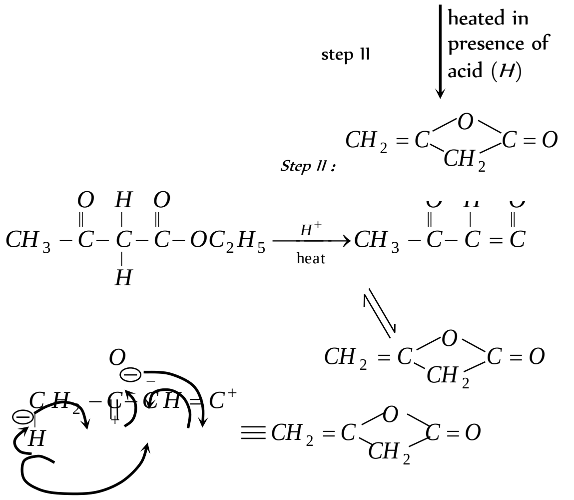
135. (b)



$C_6H_5CHO + HCN \rightarrow C_6H_5 - \underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}} - CN$ is optically active.

137. (c) *Claisen condensation*

step I $\quad CH_3CO_2C_2H_5 \xrightarrow[C_2H_5OH]{NaOC_2H_5} \underset{(A)}{CH_3COCH_2COOC_2H_5}$



$$CH_2 = C\begin{matrix} O \\ CH_2 \end{matrix}C = O$$

$$CH_3 - \overset{\overset{O}{||}}{C} - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - \overset{\overset{O}{||}}{C} - OC_2H_5 \xrightarrow[\text{heat}]{H^+} CH_3 - \overset{\overset{O}{||}}{C} - \overset{\overset{H}{|}}{C} = \overset{\overset{O}{||}}{C}$$

$$CH_2 = C\begin{matrix} O \\ CH_2 \end{matrix}C = O$$

$$\equiv CH_2 = C\begin{matrix} O \\ CH_2 \end{matrix}C = O$$

138. (d) $C_6H_5CONHCH_3 \xrightarrow[HCl]{Zn-Hg\,/} C_6H_5CH_2NHCH_3$

This reaction is known as Clemmenson reduction.

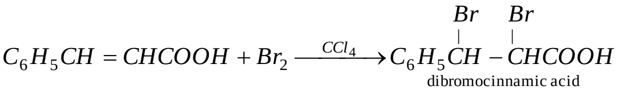
139. (b) $K_a \propto \frac{1}{pK_a}$; The value of K_a is highest for $HCOOH$.

140. (c) $X \xrightarrow{NaOH\,/\,CaO} C_2H_6$

$$\underset{\text{propionic acid}}{C_2H_5COOH} \xrightarrow{NaOH\,/\,CaO} \underset{\text{ethane}}{C_2H_6}$$

141. (a) Glycine is a amphoteric acid as it contains both acidic as well as basic groups.

142. (a) Cinnamic acid reacts with bromine in carbon tetrachloride to give dibromocinnamic acid.



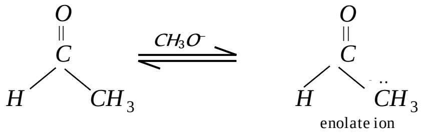
$$C_6H_5CH = CHCOOH + Br_2 \xrightarrow{CCl_4} \underset{\text{dibromocinnamic acid}}{C_6H_5\overset{\overset{Br}{|}}{CH} - \overset{\overset{Br}{|}}{C}HCOOH}$$

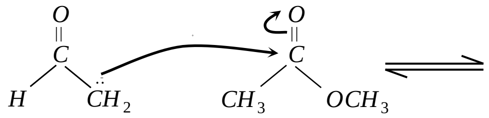
143. (a) OF all the acid derivatives, acid chlorides, i.e. CH_3COCl is most reactive.

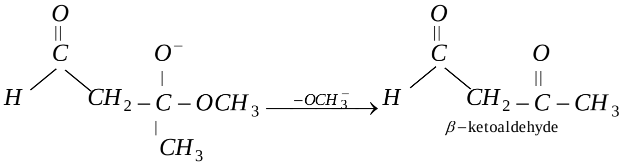
The order of reactivity of acid derivatives decreases in the following order,

$$RCOCl > (RCO)_2O > RCOOR > RCONH_2.$$

144. (c) Reaction can be explained as follows

(i) 

(ii) 

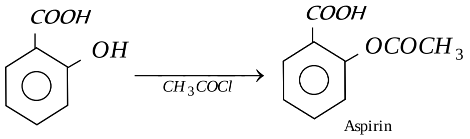


145. (a) $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

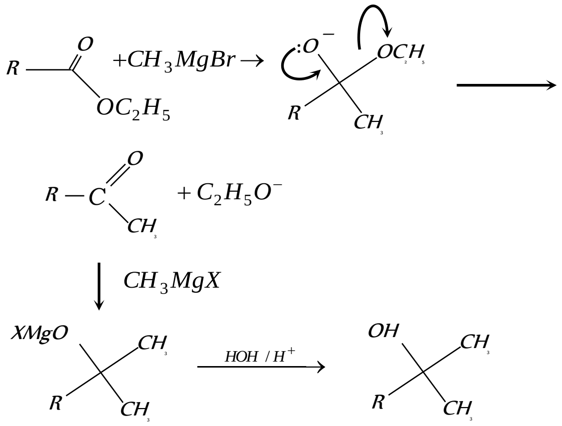
146. (d) $\begin{array}{l} RCOOH \\ RCOOH \end{array} \xrightarrow{P_2O_5} \begin{array}{l} RCO \\ RCO \end{array} > O + H_2O$

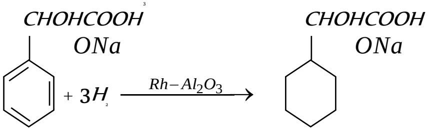
P_2O_5 acts as a dehydrating agent.

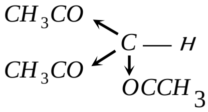
Uses of Carboxylic Acids and Their Derivatives

3. (a) 

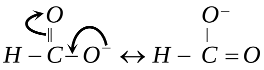
Critical Thinking Questions

1. (a) 

2. (b) 

3. (d)  So most acidic in nature.

4. (c) Anion $HCOO^-$ has two resonating structure (identical).



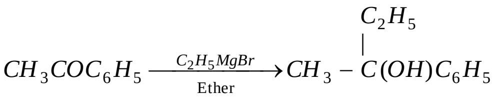
5. (a) Since a single alkyl halide is formed on treatment with *HI*, it must be a symmetrical ether *i.e.*, ethoxyethane.

$$C_2H_5OC_2H_5 + 2HI \rightarrow 2C_2H_5I + H_2O$$

6. (b) $CH_2 = CH - COOH \xrightarrow{LiAlH_4}$

$$CH_2 = CH - CH_2OH + H_2O$$

7. (a) $CH_3COOH + PCl_5 \rightarrow CH_3COCl \xrightarrow[\text{anh.}AlCl_3]{C_6H_6}$



$$CH_3COC_6H_5 \xrightarrow[\text{Ether}]{C_2H_5MgBr} CH_3 - \underset{}{\overset{C_2H_5}{\overset{|}{C}}}(OH)C_6H_5$$

8. (d) Resonance stabilization of their conjugate base *i.e.*, carboxylate ion.

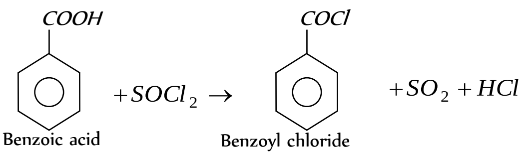
9. (a) $R - CH_2CH_2OH \xrightarrow{PBr_3} R - CH_2CH_2 - Br$

$$\xrightarrow{KCN} R - CH_2 - CH_2 - CN \xrightarrow{H_3O^+}$$

$$R - CH_2 - CH_2COOH + NH_3$$

10. (d) $\underset{\text{Propionic acid}}{CH_3CH_2COOH(aq)} + \underset{\text{sod. bicarbonate}}{NaHCO_3(aq)} \rightarrow$

$$CH_3CH_2COONa + CO_2 + H_2O$$

11. (c) 

12. (b) $-COOH$ and $-OH$ group form the hydrogen bond by which they have high boiling point. $-COOH$ group show strong hydrogen bonding so it form dimer and have more boiling point than $-OH$ group. While $-CHO$ group do not form hydrogen bond. Thus the reactivity order are as 3 > 1 > 2.

13. (c) CaC_2O_4 is a salt of oxalic acid which is more acidic than acetic acid, so it is insoluble in acetic acid.

14. (d) $-COOH$ and $COCH_3$ are meta directing group due to the presence of $-\overset{O}{\overset{\|}{C}}-$, similarly *CN* is also meta directing due to the presence of multiple bond while $NHCOCH_3$ is ortho/para directing group because of less electron density over $-\overset{O}{\overset{\|}{C}}-$ group.

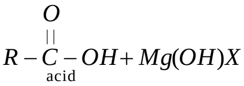
15. (c) Iodoform test is given by all the compounds having $CH_3 - \underset{O}{\underset{\|}{C}} -$ or $CH_3 - \underset{OH}{\underset{|}{C}} -$ group.

16. (c) $C_2H_5 - \underset{O}{\underset{\|}{C}} - CH_3 + I_2 + NaOH \rightarrow C_2H_5CO_2^-Na^+ + CHI_3$

$$C_2H_5CO_2^-Na^+ \xrightarrow{H^+} C_2H_5COOH + Na^+$$

17. (c) Formic acid can not be prepared by grignard's reagent. Higher acids are prepared by the reaction of CO_2 on grignard's reagent

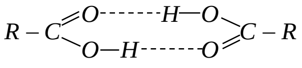
$$\overset{\delta-}{R}\ \overset{\delta+}{Mg}X + \overset{\delta+}{C} \ll \begin{array}{l} O\delta- \\ O\delta- \end{array} \rightarrow R - \underset{O}{\underset{\|}{C}} - O\,Mg\,X \xrightarrow{H.\,OH}$$



$$R-\overset{\overset{O}{||}}{\underset{\text{acid}}{C}}-OH+Mg(OH)X$$

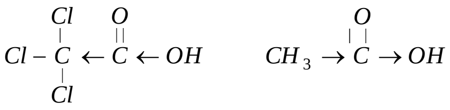
Assertion & Reason

1. (a) Carboxylic acid exist as dimer due to the formation of hydrogen bonding.



H- bonding (dimer)

2. (c) Trichloro acetic acid is stronger than acetic acid because the electron withdrawing group withdraw electrons from the carboxylate base and thus increasing the acid strength.



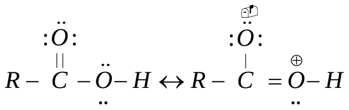
$$Cl-\underset{\underset{Cl}{|}}{\overset{\overset{Cl}{|}}{C}}\leftarrow\overset{\overset{O}{||}}{C}\leftarrow OH \qquad CH_3\rightarrow\overset{\overset{O}{||}}{C}\rightarrow OH$$

– *I* effect (Stronger acid)

+ *I* effect (Weaker acid)

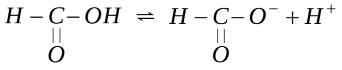
3. (c) Carboxylic acids $(RCOOH)$ dissolves in water due to hydrogen bonding between *H*-atom of $-COOH$ group and *O*-atom of water. As alkyl portion *R*-is non polar and lyophobic, this effect predominates as $-R$ gets larger (over five carbon atoms).

4. (b) As carboxylic acids are resonance stabilized they do not contain true carbonyl group as is present in carbonyl compounds.

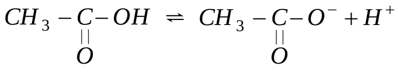


$$R-\overset{\overset{:\ddot{O}:}{||}}{C}-\underset{\cdot\cdot}{\ddot{O}}-H\leftrightarrow R-\overset{\overset{\overset{\ominus}{:\ddot{O}:}}{|}}{C}=\underset{\cdot\cdot}{\overset{\oplus}{O}}-H$$

5. (c) Formic acid is stronger than acetic acid



$$H-\underset{\underset{O}{||}}{C}-OH\rightleftharpoons H-\underset{\underset{O}{||}}{C}-O^-+H^+$$

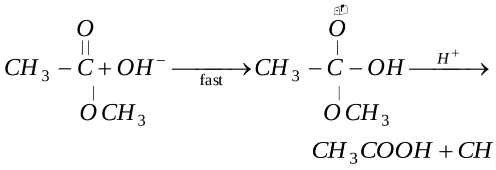


$$CH_3-\underset{\underset{O}{||}}{C}-OH\rightleftharpoons CH_3-\underset{\underset{O}{||}}{C}-O^-+H^+$$

Presence of CH_3 group in acetate ion shows +*I.E,* and there by intensifying charge on O^- of acetate ion than formate ion or acetate ion is destabilized. Thus formate ion is more stable than acetate ion or $HCOOH$ loses proton more easily than CH_3COOH.

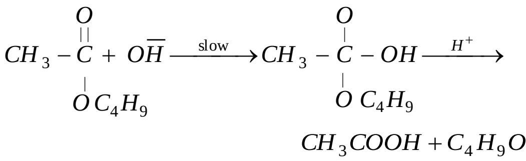
6. (e) Both fumaric and maleic acids have two ionisable H^+ *i.e.* protons. The maleate monoanion shows intramolecular *H*-bonding and thus requires more energy to give maleate dianion. It is therefore second dissociation of fumaric acid is more than maleic acid since former does not show intramolecular *H*-bonding.

7. (c) Larger is the size of alkyl group of ester, greater is the steric effect and thus lesser will be rate of hydrolysis.



$$CH_3-\underset{\underset{OCH_3}{|}}{\overset{\overset{O}{||}}{C}}+OH^-\xrightarrow[\text{fast}]{}CH_3-\underset{\underset{OCH_3}{|}}{\overset{\overset{O^{\ominus}}{|}}{C}}-OH\xrightarrow{H^+}$$

$$CH_3COOH+CH_3OH$$



$$CH_3-\underset{\underset{OC_4H_9}{|}}{\overset{\overset{O}{||}}{C}}+O\overline{H}\xrightarrow{\text{slow}}CH_3-\underset{\underset{O\,C_4H_9}{|}}{\overset{\overset{O}{|}}{C}}-OH\xrightarrow{H^+}$$

$$CH_3COOH+C_4H_9OH$$

8. (e) The melting point of an aliphatic carboxylic acid containing an even number of carbon atoms is higher than the next lower and next higher homologue containing odd number of carbon atoms.

9. (e) Electron withdrawing groups increase the acidity of carboxylic acids by stabilising the conjugate base through delocalisation of the negative charge by inductive and resonance effects.

10. (a) The larger the electron withdrawing inductive effect the greater is the acidity.

11. (c) In aminoacetic acid, NH_2 group is electron repelling in nature.

12. (b) Boiling points of carboxylic acids are higher due to their tendency to associate and form dimers to a greater extent by hydrogen bonding.

13. (a) Both formic acid and oxalic acid behave as reducing agent and decolourise acidified $KMnO_4$ solution.

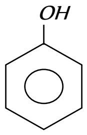
$$2KMnO_4+3H_2SO_4\rightarrow K_2SO_4+2MnSO_4$$
$$+3H_2O+5[O]$$

14. (c) Esters containing $\alpha-$hydrogens on treatment with a base form a carbanion which brings about nucleophilic acyl substitution at the carbonyl group of the other molecule of the ester to form $\beta-$keto esters.

Carboxylic acids and Their derivatives

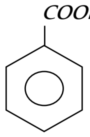
SET Self Evaluation Test - 28

1. Which of the following is the weakest acid [CPMT 2001]

(a) 

(b) CH_3COOH

(c) $HCOOH$

(d) 

2. Pyruvic acid is obtained by [AFMC 1995]
   - (a) Oxidation of acetaldehyde cyanohydrin
   - (b) Oxidation of acetone cyanohydrin
   - (c) Oxidation of formaldehyde cyanohydrin
   - (d) None of these

3. The product obtained by dry distillation of calcium formate on reacting with ammonia yields
   - (a) Formamide
   - (b) Acetamide
   - (c) Acetaldehyde ammonia
   - (d) Urotropine

4. In the reaction

$$C_8H_6O_4 \xrightarrow{\Delta} X \xrightarrow{NH_3}$$

The compound X is [Roorkee Qualifying 1998]
   - (a) Phthalic anhydride
   - (b) Phthalic acid
   - (c) *o*-xylene
   - (d) Benzoic acid

5. Ethyl acetate reacts with CH_3MgBr to form [MP PET 1999]
   - (a) Secondary alcohol
   - (b) Tertiary alcohol
   - (c) Primary alcohol and acid
   - (d) Acid

6. In quick vinegar process of acetic acid, the temperature of mixture is [RPMT 2003]
   - (a) 300 K
   - (b) 427 K
   - (c) 500 K
   - (d) 350 K

7. Formic acid can reduce [CPMT 1987]
   - (a) Tollen's reagent
   - (b) Mercuric chloride
   - (c) $KMnO_4$
   - (d) All of these

8. 0.2 gm of fine animal charcoal is mixed with half litre of acetic acid $(-SM)$ solution and shaken for 30 minutes [BHU 1998]
   - (a) The concentration of the solution decreases
   - (b) Concentration increases
   - (c) Concentration remains same
   - (d) None of these

9. Dimerisation in carboxylic acid is due to [KCET 2002]
   - (a) Ionic bond
   - (b) Covalent bond
   - (c) Coordinate bond
   - (d) Intermolcular hydrogen bond

10. A colourless organic compound gives brisk effervescences with a mixture of sodium nitrite and dil. HCl. It could be [CPMT 1978]
    - (a) Glucose
    - (b) Oxalic acid
    - (c) Urea
    - (d) Benzoic acid

11. What is formed when benzoyl chloride reacts with aniline in presence of sodium hydroxide [BHU 1996]
    - (a) Acetanilide
    - (b) Benzanilide
    - (c) Benzoic acid
    - (d) Azobenzene

12. Strong acid among the following is [CBSE PMT 1992; AFMC 1998; BHU 2000]
    - (a) CF_3COOH
    - (b) CBr_3COOH
    - (c) CH_3COOH
    - (d) CCl_3COOH

13. Aspirin is obtained by the reaction of salicylic acid with [AFMC 1998]
    - (a) Acetone
    - (b) Acetaldehyde
    - (c) Acetyl chloride
    - (d) Acetic anhydride

14. Oxalic acid when reduced with zinc and H_2SO_4 gives [Tamil Nadu CET 2001]
    - (a) Glyoxallic acid
    - (b) Glyoxal
    - (c) Glycollic acid
    - (d) Glycol

15. A distinctive and characteristic functional group in fats is [NCERT 1981; MP PET 1995]
    - (a) A ketonic group
    - (b) An ester group
    - (c) A peptide group
    - (d) An alcoholic group

16. Which substance will give amide when heated with NH_3 [CPMT 1997]
    - (a) Potassium
    - (b) Hydrogen
    - (c) Ethane
    - (d) Nitrogen

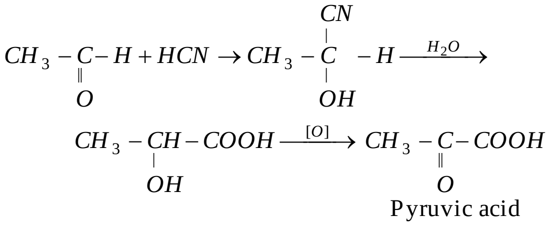
17. Which acid has least pK_a value [CPMT 1982]
    - (a) $Cl_3C.COOH$
    - (b) $Cl_2CH.COOH$
    - (c) $Cl.CH_2COOH$
    - (d) CH_3COOH

AS Answers and Solutions

(SET -28)

1. (a) Phenol is a weaker acid than carboxylic acids.

2. (a)



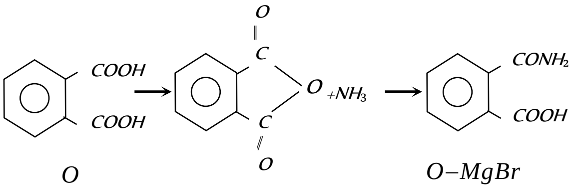
$$CH_3-\underset{\underset{O}{\|}}{C}-H+HCN\rightarrow CH_3-\overset{\overset{CN}{|}}{\underset{\underset{OH}{|}}{C}}-H\xrightarrow{H_2O}$$

$$CH_3-\underset{\underset{OH}{|}}{CH}-COOH\xrightarrow{[O]}\underset{\text{Pyruvic acid}}{CH_3-\underset{\underset{O}{\|}}{C}-COOH}$$

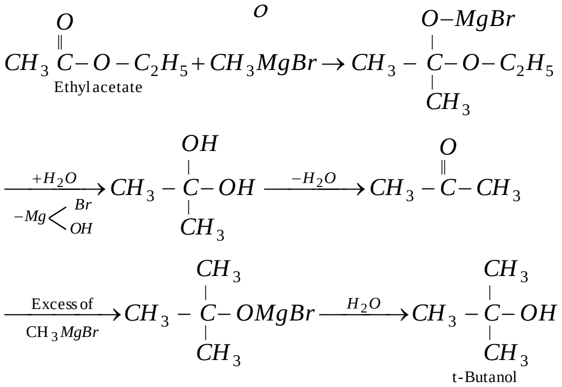
3. (d) $\underset{\text{Calcium formate}}{2(HCOO)_2Ca}\xrightarrow{\text{Dry distillation}}\underset{\text{Formaldehyde}}{2HCHO}+2CaCO_3$

$6HCHO+4NH_3\rightarrow\underset{\text{Urotropin}}{(CH_2)_6N_4}+6H_2O$

4. (a)



5. (b)



$$CH_3\overset{\overset{O}{\|}}{C}-O-C_2H_5+CH_3MgBr\rightarrow CH_3-\overset{\overset{O-MgBr}{|}}{\underset{\underset{CH_3}{|}}{C}}-O-C_2H_5$$

(Ethyl acetate)

$$\xrightarrow[-Mg\langle^{Br}_{OH}]{+H_2O}CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH\xrightarrow{-H_2O}CH_3-\overset{\overset{O}{\|}}{C}-CH_3$$

$$\xrightarrow[\text{CH}_3MgBr]{\text{Excess of}}CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OMgBr\xrightarrow{H_2O}\underset{\text{t-Butanol}}{CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH}$$

6. (a) $CH_3CH_2OH+O_2\xrightarrow[300\,K]{Acetobacter}\underset{\text{8-10\% acetic acid (vinegar)}}{CH_3COOH}+H_2O$

7. (d) Tollen's reagent - $HCOOH+Ag_2O\rightarrow CO_2+H_2O+\underset{\text{(silver mirror)}}{2Ag}$

Fehling solution –

$HCOOH+2CuO\rightarrow CO_2+H_2O+\underset{\text{(Red ppt)}}{Cu_2O}$

Mercury chloride –

$2HCOOH+2HgCl_2\rightarrow 2CO_2+4HCl+\underset{\text{(Black)}}{2Hg}$

8. (a) Activated charcoal adsorbed the impurity of acetic acid by which the concentration of acetic acid solution decrease.

9. (d) Intermolecular hydrogen bonding leads to dimerisation of carboxylic acid in non-aqueous solvents.

10. (c) $NaNO_2+HCl\rightarrow HNO_2+NaCl$

$\underset{\text{Urea}}{H_2NCONH_2}+HNO_2\rightarrow CO_2+NH_3+H_2O+N_2$

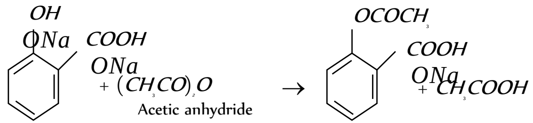
CO_2 evolve with brisk effervescence.

11. (b) It is known as Schotten Baumann reaction.

$\underset{\text{Aniline}}{C_6H_5NH_2}+\underset{\text{Benzoyl chloride}}{ClCOC_6H_5}\xrightarrow{NaOH}\underset{\text{Benzanilide}}{C_6H_5NHCOC_6H_5}+HCl$

12. (a) Due to $-I$ effect of three F atom CF_3COOH is a strong acid.

13. (d)

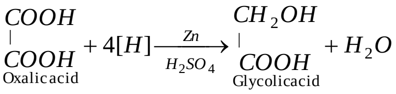


Acetic anhydride

Salicylic acid

Aspirin or Acetyl salicylic acid

14. (c)



$$\underset{\text{Oxalic acid}}{\overset{COOH}{\underset{COOH}{|}}}+4[H]\xrightarrow[H_2SO_4]{Zn}\underset{\text{Glycolic acid}}{\overset{CH_2OH}{\underset{COOH}{|}}}+H_2O$$

15. (b) Fat is the ester of higher acids & glycerol.

16. (a) $2K+2NH_3\rightarrow 2KNH_2+H_2$

17. (a) $(Cl_3C-COOH)$ Trichloroacetic acid has least *pka* value and is most acidic.