



## CHEMISTRY

### JEE (MAIN AND ADVANCED) CHEMISTRY

### CARBOXYLIC ACIDS AND DERIVATIVES

#### Problem

1. Attachment of vinyl group or phenyl group directly to carboxylic acid group has effect on the acidic character of that carboxylic acid. Explain.

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2. Why oxalic acid is a stronger acid than acetic acid?

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3. Why benzoic acid is a stronger acid than acetic acid?



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4. Explain why carboxylic acids are stronger acids than phenols?



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5. Chloroacetic acid is stronger acid than acetic acid. Explain.



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6. How is formic acid prepared ?



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7. Write sequence of steps for the conversion of formic acid to acetic acid ?



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8. How is acetic acid converted to formic acid ?



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9. How is benzoic acid prepared from benzene?



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10. Show how Acetophenone compound can be converted to benzoic acid.



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11. Write chemical reactions to affect the following transformations :

Benzyl alcohol to phenylethanoic acid



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12. What happens when malonic acid is heated ?



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13. Explain the orientation of -COOH group, when present on benzene ring.



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14. How is formic acid distinguished from acetic acid ?



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15. Acetic acid has a molecular mass of 120 when dissolved in benzene.

Why?



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16. How is acetic acid converted separately to methylamine and ethylamine?



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17. Explain the conversion of acetic acid into methane and ethane in separate steps.



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18. Hydrolysis of an ester in presence of NaOH is called saponification. Explain.



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19. Give the order of reactivity of various acid derivatives towards nucleophilic substitution. Solution



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20. How is acetamide converted to methamine?



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21. Write sequence of reactions to convert acetic acid into 2-propanol.



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## Exercise 4 1 1

1. Write examples and names of carboxylic acids.



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2. Write on the dissociation equilibrium of carboxylic acids.



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3. Carboxylic acids are weak organic acids. Discuss the relative acidic strength of carboxylic acids based on  $K_a$  values.



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4. Draw the structures of Hex-2-en-4-ynoic acid and 3-chloro-4-phenylpentanoic acid.



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5. Write IUPAC names of

$CH_3COCH_2COCH_3$  and  $(CH_3)_3CCH_2COOH$ .



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### Exercise 4 1 2

1. How is acetic acid prepared? Explain the properties of acetic acid.



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2. How is acetic acid obtained from: (a) ethanol, (b) acetonitrile and (c) Grignard reagent.



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3. Write equations for the reaction of acetic acid with the following reagents :

(a)  $Na$ , (b)  $NaOH$ , (c)  $NaHCO_3$ , (d)  $NH_3$ , and (e)  $Cl_2$  / red P.



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4. How is acetic acid converted to (a) acetone, (b) ethane and (c) ethyl amine.



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5. How the strength of an acid changes with inductive and mesomeric effects exerted by various groups present in it.



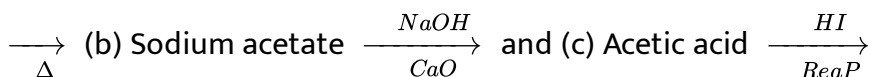
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6. What happens when acetic acid is (a) heated with  $P_2O_5$ , (b) treated with  $LiAlH_4$  and (c) treated with  $SOCl_2$ ?



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7. Write the equations for the following reactions: (a) Calcium acetate



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8. Write short notes on : (a) HVZ reaction and (b) Esterification.



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9. Explain why the boiling point of acetic acid is higher than that of aldehydes and alcohols having same molar mass.



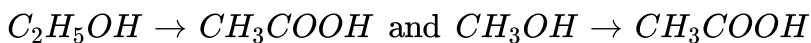
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10. Write the important uses of acetic acid.



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11. Write the conversions



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12. Complete the reactions : (a)  $CH_3COOH \xrightarrow[\Delta]{P_4O_{10}}$  , (b)  $CH_3COOH \xrightarrow{LiAlH_4}$



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13. Although phenoxide ion has more number of resonating structures than carboxylate ion, carboxylic acid is a stronger acid than phenol. Why?





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### Exercise 4 1 3

1. Explain how ethyl acetate is prepared? Discuss its properties.



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2. How is acetamide prepared? What are its properties?



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3. How is acetyl chloride prepared? Discuss its properties.



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4. Discuss the methods of preparation and properties of acetic anhydride.



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5. Write short notes on the Hofmann hypobromite reaction with mechanism.



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## Exercise 4 2

1. What is Etard reaction ? Give equation.



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2. Wxplain Gattermann-Koch reaction for the formation of benzaldehyde



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3. Explain why carboxylic acids are stronger acids than phenols?



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4. How is inductive effect useful to explain the relative strength of aliphatic carboxylic acids? Explain with suitable examples.



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5. Acetic acid is stronger acid than peroxyacetic acid? Why?



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6. How is benzoic acid prepared ? What are its properties?



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7. How is lactic acid prepared ? Write two reactions of lactic acid.



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8. Write the mechanism of Claisen condensation.



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9. Discuss the geometrical isomerism exhibited by maleic and fumaric acids. How they differ in properties?



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10. Write the order of acidic strengths of benzoic acid and isomeric chlorobenzoic acids.



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11. Explain how succinic acid is prepared .



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12. Write the mechanism of Hoffmann bromamide reaction.



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13. Write the mechanism of acid and alkaline hydrolysis of esters.



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14. The boiling points of carboxylic acids are higher than those of alcohols. Explain with suitable examples.



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15. Give equations for the reaction of acetic acid with (i)  $PCl_3$  (ii)  $PCl_5$  (iii)  $SOCl_2$ .



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16. Give the order of reactivity of various acid derivatives towards nucleophilic substitution. Solution



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17. Nitrobenzene to benzoic acid



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18. Predict the order of acidic nature of (i) p-nitrobenzoic acid (ii) p-methylbenzoic acid (iii) p-chlorobenzoic acid (iv) p-methoxybenzoic acid



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19. The first ionisation constant of oxalic acid is much greater than its second ionisation constant. Justify.



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20. "Salts of acetic acid are useful in the preparation of several organic compounds". Account for the observation with suitable examples.



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21. Explain how acetic acid can be converted to: glycine and lactic acid.



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22. Acid halides undergo esterification at a faster rate than acids. Explain?



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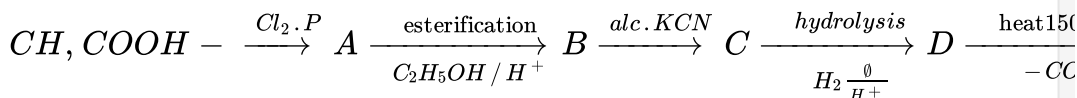
23.  $C_6H_5CONH_2 \xrightarrow{dil. NaOH} A \xrightarrow[CaO]{NaOH} B \xrightarrow[AlCl_3]{CH_3Cl} C$ . Name the reaction in the formation of C from B.

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24.  $C_6H_6 + Br_2 \xrightarrow{AlCl_3} A \xrightarrow{Mg, ether} B \xrightarrow{CO_2} C \xrightarrow{H_2O^+} D$ . Write the organic products A, B, C and D. Discuss these conversions.

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25.



Name the functional isomer of compound E in the above sequence.

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1. Methanol to acetic acid



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2. Ethanoic acid to propanoic acid



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3. Benzene to methylbenzoate



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4. Propanoic acid to acetic acid



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5. Nitrobenzene to benzoic acid



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6. Benzene to phenylacetic acid .



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7. Benzene to p-nitrobenzoic acid



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8. Benzene to m-nitrobenzoic acid .



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9. Benzene to m-nitroacetophenone .





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10. Ethylbenzene to benzoic acid



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11. Bromobenzene to benzoic acid .



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12. Styrene to benzoic acid



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13. Acetophenone to benzoic acid



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14. Write chemical reactions of affect the 4-Methylacetophenone to benzene -1,4 -dicarboxylic acid transformations.



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15. Butanol-1 to butanoic acid .



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16. Write chemical reactions of affect the Cyclohexene to hexane-1, 6-dioic acid transformations.



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17. Write chemical reactions of affect the Butanal to butanoic acid transformations.



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**18.** 3-Nitrobromobenzene to 3-nitrobenzoic acid .



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**19.** Write chemical reactions to affect the following transformations :

Benzyl alcohol to phenylethanoic acid



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