



Attempt all questions before checking the answer key. Use structural formulae and balanced equations where feasible. State reagents and work-up for conversions.

A. Very short answers - 1 mark each

1. Name $\text{CH}_3\text{CH}_2\text{COCH}_3$ by IUPAC rules.
2. Why is the carbonyl carbon electrophilic?
3. Which gives Tollens' test: propanal or propanone?
4. What structural feature is required for an aldol reaction?
5. Name the reaction in which an aldehyde without α -hydrogen disproportionates in concentrated alkali.
6. Why are carboxylic acids generally stronger acids than phenols?

B. Short answers / practice - 2 marks each

7. Write reduction of ethanal to ethanol and oxidation of ethanal to ethanoic acid.
8. Give a chemical test to distinguish propanal from propanone, with observation.
9. Write the iodoform reaction of propanone, showing the products.
10. Explain why aldehydes are generally more reactive than ketones towards nucleophilic addition.
11. Compare acidity of CH_3COOH and ClCH_2COOH with reasons.
12. Write esterification of ethanoic acid with ethanol, including catalyst and reversibility.
13. Does methanal undergo a self-aldol reaction?
14. Name $\text{CH}_3\text{CH}_2\text{CHO}$.
15. Find CO_2 moles formed when 1 mol ethanoic acid reacts with excess NaHCO_3 .
16. Does propanone give the iodoform test?
17. Predict the product of ethanoic acid with LiAlH_4 followed by hydrolysis.
18. Explain why chloroethanoic acid is stronger than ethanoic acid.

C. Short answers - 3 marks each

19. Write the mechanism of cyanohydrin formation from ethanal under base-catalysed conditions.
20. Write aldol addition of ethanal and its dehydration product, naming both.

21. Write the Cannizzaro reaction of benzaldehyde and explain the oxidation/reduction changes.

22. Give conversions: benzene to acetophenone, benzoyl chloride to benzaldehyde and ethanenitrile to ethanoic acid.

23. Explain why benzoic acid does not give Friedel-Crafts alkylation readily and why its carboxyl group is meta-directing.

24. Write Hell-Volhard-Zelinsky reaction for propanoic acid and sodium-hydrogen-carbonate reaction for ethanoic acid.

D. Long answers - 5 marks each

25. Compare aldol and Cannizzaro reactions in substrate requirements, reagents and products. Give full equations using ethanal and benzaldehyde and explain why each follows its pathway.

26. Explain nucleophilic addition to carbonyls. Compare HCN , NaHSO_3 and hydroxylamine additions with products, and discuss steric/electronic effects on aldehyde-ketone reactivity.

27. Identify compounds in $\text{CH}_3\text{CH}_2\text{OH} \rightarrow \text{A} \rightarrow \text{B}$, where A gives Tollens' test and B releases CO_2 with NaHCO_3 . Write reagents for each step, convert B to an ester and explain all observations.

28. An organic compound $\text{C}_4\text{H}_8\text{O}$ gives a positive 2,4-DNP test and iodoform test but negative Tollens' test. Identify it, justify the structure, and write its reduction and iodoform reactions.

29. Give conversions with essential reagents: toluene to benzoic acid, ethanoic acid to ethanoyl chloride, ethanoyl chloride to ethanal, and propanone to propane by each of two standard carbonyl-reduction methods.

30. Explain acidity of carboxylic acids using resonance and inductive effects. Arrange CH_3COOH , ClCH_2COOH , Cl_2CHCOOH and CCl_3COOH by acidity; write reactions of ethanoic acid with NaOH , Na_2CO_3 and NH_3 followed by heating.

ANSWER KEY - Numerical / short answers

13) No; it has no α -hydrogen. 14) Propanal. 15) 1 mol. 16) Yes; it contains $\text{CH}_3\text{CO}-$. 17) Ethanol. 27) A=ethanal; B=ethanoic acid. 28) Butan-2-one; reduction gives butan-2-ol.