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Aldehydes, Ketones and Carboxylic Acids — CBSE Class 12 Chemistry Chapter Test

FREE CHAPTER TEST · CLASS XII · CHEMISTRY (043) · PATTERN OF THE CBSE SAMPLE QUESTION PAPER 2026-27

TIME ALLOWED	MAXIMUM MARKS	QUESTIONS	NAME / ROLL NO.
1½ hours	37	17 (A 8 · B 3 · C 3 · D 1 · E 2)	

GENERAL INSTRUCTIONS

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 17 questions. All questions are compulsory.
2. This question paper is divided into five sections: A, B, C, D and E.
3. Section A (Q1–8) contains 6 multiple choice questions and 2 assertion-reason based questions of 1 mark each.
4. Section B (Q9–11) contains short answer questions of 2 marks each.
5. Section C (Q12–14) contains short answer questions of 3 marks each.
6. Section D (Q15) contains case-based questions of 4 marks each, with sub-parts of 1, 1 and 2 marks.
7. Section E (Q16–17) contains long answer questions of 5 marks each.
8. There is no overall choice. However, an internal choice has been provided in 1 question in Section B, 1 question in Section C, 1 question in Section D, 2 questions in Section E. Attempt only one of the alternatives in such questions.
9. Use of log tables and calculators is not allowed.
10. This chapter test follows the section structure, question types and marks per question of the CBSE Class XII Chemistry (043) Sample Question Paper 2026-27, at about half the length of the 70-mark board paper: 37 marks in 1½ hours.
11. The answer key and the marking scheme are at the end of this booklet. Attempt the paper in 1½ hours before you look at them.

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Chapter: Aldehydes, Ketones and Carboxylic Acids · **Topics:** Nomenclature and structure of the carbonyl group · Preparation of aldehydes and ketones · Nucleophilic addition and other reactions · Aldol and Cannizzaro reactions · Acidity of carboxylic acids · Preparation and reactions of carboxylic acids

SECTION A

This section comprises 8 questions of 1 mark each: 6 multiple choice questions (MCQs) and 2 assertion-reason based questions.

1. Which of the following gives a yellow precipitate of iodoform with iodine and sodium hydroxide? 1

(A) Benzaldehyde (B) Propanal

(C) Pentan-3-one (D) Propanone

2. Benzoic acid is nitrated with a mixture of concentrated nitric and sulphuric acids. The main product is 1

(A) 3-nitrobenzoic acid (B) 2-nitrobenzoic acid

(C) 4-nitrobenzoic acid (D) nitrobenzene

3. Which of the following undergoes the Cannizzaro reaction? 1

(A) Ethanal (B) Propanone

(C) Benzaldehyde (D) Propanal

4. Propanal and propanone are 1

(A) position isomers (B) functional isomers

(C) chain isomers (D) the same compound

5. Ethanal is treated with dilute NaOH and the product is heated. The final product is 1

(A) 3-hydroxybutanoic acid (B) ethanol and ethanoic acid

(C) butan-1-ol (D) but-2-enal

6. The IUPAC name of $C_6H_5COCH_3$ (acetophenone) is 1

(A) 1-phenylethanone (B) 2-phenylethanal

(C) benzyl methyl ketone (D) methyl benzoate

7. **Assertion (A) :** Aldehydes are generally more reactive than ketones in nucleophilic addition reactions. 1
Reason (R) : The boiling points of aldehydes are higher than those of alkanes of comparable molecular mass.

(A) Both A and R are true, and R is the correct explanation of A.

(B) Both A and R are true, and R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

8. **Assertion (A) :** Methanoic acid reduces Tollens' reagent. 1
Reason (R) : Methanoic acid is a weaker acid than ethanoic acid.

(A) Both A and R are true, and R is the correct explanation of A.

(B) Both A and R are true, and R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

SECTION B

This section comprises 3 short answer questions of 2 marks each.

9. Write the IUPAC names of (i) $CH_3CH(CH_3)CH_2CHO$ and (ii) $CH_3COCH_2CH(CH_3)_2$. 2

10. (a) Why does the carbonyl group of aldehydes and ketones undergo nucleophilic addition? Why does the carbonyl group of carboxylic acids not give the typical addition reactions of aldehydes and ketones? 2

OR

(b) Write the equations for the Rosenmund reduction of benzoyl chloride and the Stephen reaction of ethanenitrile.

11. Give one chemical test each to distinguish between (i) propanal and propanone and (ii) phenol and benzoic acid. 2

SECTION C

This section comprises 3 short answer questions of 3 marks each.

12. (a) (i) Write the equation for the aldol condensation of propanone in the presence of $Ba(OH)_2$, including the dehydration of the aldol product on heating. 3
(ii) A mixture of ethanal and propanal is treated with dilute NaOH and heated. How many α,β-unsaturated aldehydes can be formed? Name them.

OR

(b) (i) Write the equation for the Cannizzaro reaction of benzaldehyde, and state what happens to the two molecules.
(ii) Why does ethanal not undergo the Cannizzaro reaction?
(iii) In the cross-Cannizzaro reaction of methanal and benzaldehyde, which aldehyde is oxidised?

13. (i) Arrange CH_3COOH, $ClCH_2COOH$, FCH_2COOH and $Cl_2CHCOOH$ in order of increasing acid strength, and explain the order. 3
(ii) Why are carboxylic acids stronger acids than phenols?

14. Write the equations for the following conversions: 3
(i) ethanoic acid to ethanamide;
(ii) sodium benzoate to benzene;
(iii) ethanoic acid to 2-chloroethanoic acid.

SECTION D

This section comprises 1 case-based question of 4 marks, with sub-parts of 1, 1 and 2 marks.

15. A compound X has the molecular formula C_4H_8O. It forms an orange precipitate with 2,4-dinitrophenylhydrazine, does not reduce Tollens' reagent or Fehling's solution, and gives a yellow precipitate when warmed with iodine and sodium hydroxide.

(I) Which functional group is present in X? Give a reason. [1]

(II) Write the structure and the IUPAC name of X. [1]

(III) Write the balanced equation for the reaction of X with iodine and sodium hydroxide, and name the yellow precipitate. [2]

OR

(III) Write the products of the reduction of X (i) with zinc amalgam and concentrated HCl and (ii) with $NaBH_4$. Is the second product chiral? [2]

SECTION E

This section comprises 2 long answer questions of 5 marks each.

16. (a) (i) Write the equations for the preparation of (I) benzaldehyde from toluene by the Etard reaction, (II) benzaldehyde from benzene by the Gattermann-Koch reaction and (III) ethanal by the ozonolysis of but-2-ene. 5
(ii) Write one equation each for the Clemmensen and the Wolff-Kishner reductions.

OR

(b) (i) Explain the mechanism of the nucleophilic addition of HCN to a carbonyl compound.
(ii) Why are ketones less reactive than aldehydes towards nucleophilic addition?
(iii) Write the products of the reaction of propanone with HCN, hydroxylamine and hydrazine.

17. (a) (i) Write one equation each for the preparation of a carboxylic acid (I) from a primary alcohol, (II) from a nitrile, (III) from a Grignard reagent and (IV) from an alkylbenzene. 5
(ii) Write the equations for the decarboxylation of sodium ethanoate and for the Kolbe electrolysis of sodium ethanoate.

OR

(b) (i) Why do carboxylic acids have higher boiling points than alcohols of comparable molecular mass?
(ii) Write the equations for the reaction of ethanoic acid with (I) PCl_5, (II) P_2O_5 on heating, (III) $LiAlH_4$ followed by water and (IV) ethanol in the presence of concentrated sulphuric acid.

END OF THE QUESTION PAPER

ANSWER KEY — SECTION A

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
(D)	(A)	(C)	(B)	(D)	(A)	(B)	(C)

MARKING SCHEME AND WORKED SOLUTIONS

Marks for each step are shown in brackets, as in the CBSE marking scheme. Any correct alternative method earns full marks.

Q1. Answer (D). Methyl ketones ($CH_3CO–$) give the iodoform test; propanone is CH_3COCH_3.

Q2. Answer (A). The –COOH group withdraws electrons from the ring and is meta-directing.

Q3. Answer (C). The Cannizzaro reaction needs an aldehyde with no α-hydrogen.

Q4. Answer (B). Both are C_3H_6O, but propanal has an aldehyde group and propanone a ketone group.

Q5. Answer (D). Aldol (3-hydroxybutanal) loses water on heating to give the α,β-unsaturated aldehyde but-2-enal.

Q6. Answer (A). It is ethanone with a phenyl group on the carbonyl carbon, C-1. Benzyl methyl ketone is $C_6H_5CH_2COCH_3$, and methyl benzoate is an ester.

Q7. Answer (B). Both are true, but the reactivity is due to less steric hindrance and less electron release at the carbonyl carbon of aldehydes, not to boiling points. Answer B.

Q8. Answer (C). Methanoic acid, H–COOH, contains an aldehyde-like H–C=O group, so A is true. It is a stronger acid than ethanoic acid (no electron-releasing CH_3), so R is false. Answer C.

Q9. (2 marks) Answer: 3-methylbutanal; 4-methylpentan-2-one.
(i) 3-Methylbutanal. [1]
(ii) 4-Methylpentan-2-one. [1]

Q10. (2 marks) Answer: (a) δ+ carbonyl carbon; resonance in acids; (b) Rosenmund and Stephen equations.
(a) Oxygen is more electronegative than carbon, so the carbonyl carbon carries a partial positive charge and is attacked by nucleophiles; the π bond breaks easily. [1] In carboxylic acids the lone pair of the –OH oxygen is delocalised onto the C=O (resonance), which reduces the positive character of the carbonyl carbon. [1]
OR (b) Rosenmund: $C_6H_5COCl + H_2$ (Pd–$BaSO_4$) → $C_6H_5CHO + HCl$. [1] Stephen: $CH_3CN + SnCl_2/HCl \rightarrow CH_3CH{=}NH$ (imine), which is hydrolysed: $CH_3CH{=}NH + H_2O \rightarrow CH_3CHO + NH_3$. [1]

Q11. (2 marks) Answer: Tollens/Fehling; $NaHCO_3$ or $FeCl_3$.
(i) Tollens' reagent: propanal gives a silver mirror, propanone does not (or Fehling's solution: red precipitate with propanal). [1]
(ii) $NaHCO_3$ solution: benzoic acid gives brisk effervescence of CO_2, phenol does not (or neutral $FeCl_3$: violet colour with phenol). [1]

Q12. (3 marks) Answer: (a) 4-methylpent-3-en-2-one; four products; (b) benzyl alcohol and sodium benzoate.
(a) (i) $2CH_3COCH_3$ ($Ba(OH)_2$) ⇌ $(CH_3)_2C(OH)CH_2COCH_3$ (4-hydroxy-4-methylpentan-2-one); on heating → $(CH_3)_2C{=}CHCOCH_3 + H_2O$ (4-methylpent-3-en-2-one). [1]
(ii) Four, since each aldehyde can act as the donor (enolate) or the acceptor: [½] but-2-enal (ethanal + ethanal), 2-methylpent-2-enal (propanal + propanal), pent-2-enal (enolate of ethanal + propanal), 2-methylbut-2-enal (enolate of propanal + ethanal). [1½]
OR (b) (i) $2C_6H_5CHO$ + conc. NaOH → $C_6H_5CH_2OH + C_6H_5COONa$. [1] One molecule is reduced and the other oxidised (disproportionation). [½]
(ii) Ethanal has α-hydrogens, so with a base it forms an enolate and undergoes aldol condensation instead. [1] (iii) HCHO + C_6H_5CHO (conc. NaOH) → $HCOONa + C_6H_5CH_2OH$: methanal is oxidised. [½]

Q13. (3 marks) Answer: $CH_3COOH < ClCH_2COOH < FCH_2COOH < Cl_2CHCOOH$.
(i) $CH_3COOH < ClCH_2COOH < FCH_2COOH < Cl_2CHCOOH$. [1] Electron-withdrawing halogens (−I effect) stabilise the carboxylate ion; F withdraws more than Cl, and two Cl atoms more than one. [1]
(ii) In the carboxylate ion the negative charge is shared equally by two (electronegative) oxygen atoms; in the phenoxide ion it is spread onto less electronegative carbon atoms, and the structures are not equivalent. [1]

Q14. (3 marks) Answer: ammonium salt then amide; soda-lime; HVZ.
(i) $CH_3COOH + NH_3 \rightarrow CH_3COONH_4$; heat $\rightarrow CH_3CONH_2 + H_2O$. [1]
(ii) $C_6H_5COONa + NaOH$ (CaO, heat) $\rightarrow C_6H_6 + Na_2CO_3$ (decarboxylation). [1]
(iii) $CH_3COOH + Cl_2$ (red P) $\rightarrow ClCH_2COOH + HCl$ (Hell-Volhard-Zelinsky reaction). [1]

Q15. (4 marks) Answer: (I) ketone; (II) butan-2-one; (III) iodoform, or butane and butan-2-ol (chiral).
(I) A ketone: it forms a 2,4-DNP derivative (a carbonyl compound) but does not reduce Tollens' or Fehling's reagent (not an aldehyde). [1]
(II) $CH_3COCH_2CH_3$, butan-2-one (it has the $CH_3CO–$ group needed for the iodoform test). [1]
(III) $CH_3COCH_2CH_3 + 3I_2 + 4NaOH \rightarrow CHI_3 + CH_3CH_2COONa + 3NaI + 3H_2O$. [1] The yellow precipitate is iodoform (triiodomethane). [1]
OR (III) (i) Butane, $CH_3CH_2CH_2CH_3$ (Clemmensen reduction). [1] (ii) Butan-2-ol, $CH_3CH(OH)CH_2CH_3$; yes, C-2 carries four different groups. [1]

Q16. (5 marks) Answer: (a) Etard, Gattermann-Koch, ozonolysis; Zn–Hg/HCl and NH_2NH_2/KOH; (b) cyanohydrin, oxime, hydrazone.
(a) (i) (I) $C_6H_5CH_3 + CrO_2Cl_2$ (in CS_2) $\rightarrow$ chromium complex; hydrolysis (H_3O^+) $\rightarrow C_6H_5CHO$. [1] (II) $C_6H_6 + CO + HCl$ (anhydrous $AlCl_3$/CuCl) $\rightarrow C_6H_5CHO + HCl$. [1] (III) $CH_3CH=CHCH_3 + O_3 \rightarrow$ ozonide; $Zn/H_2O \rightarrow 2CH_3CHO$. [1]
(ii) Clemmensen: $CH_3COCH_3 + 4[H]$ (Zn–Hg, conc. HCl) $\rightarrow CH_3CH_2CH_3 + H_2O$. [1] Wolff-Kishner: $CH_3COCH_3 + NH_2NH_2 \rightarrow (CH_3)_2C=NNH_2 + H_2O$; then KOH/ethylene glycol, heat $\rightarrow CH_3CH_2CH_3 + N_2$. [1]
OR (b) (i) The nucleophile (CN^-, from HCN with a base) attacks the δ+ carbonyl carbon from above the plane; the carbon changes from sp^2 to sp^3 and a tetrahedral alkoxide intermediate forms. [1] The intermediate takes a proton from HCN (or the medium) to give the cyanohydrin. [1]
(ii) Ketones have two electron-releasing alkyl groups that reduce the δ+ charge of the carbonyl carbon and hinder the approach of the nucleophile. [1]
(iii) Propanone + HCN $\rightarrow (CH_3)_2C(OH)CN$, propanone cyanohydrin. [½] + $NH_2OH \rightarrow (CH_3)_2C=NOH$, propanone oxime. [½] + $NH_2NH_2 \rightarrow (CH_3)_2C=NNH_2$, propanone hydrazone. [1]

Q17. (5 marks) Answer: (a) four methods; methane; ethane (Kolbe electrolysis); (b) dimers; ethanoyl chloride, anhydride, ethanol, ethyl ethanoate.
(a) (i) (I) $CH_3CH_2OH + 2[O]$ (alkaline $KMnO_4$, then H^+) $\rightarrow CH_3COOH + H_2O$. [½] (II) $CH_3CN + 2H_2O$ (H^+) $\rightarrow CH_3COOH + NH_3$. [1] (III) $CH_3MgBr + CO_2 \rightarrow CH_3COOMgBr$; + H_2O (H^+) $\rightarrow CH_3COOH + Mg(OH)Br$. [1] (IV) $C_6H_5CH_3$ ($KMnO_4$–KOH, heat, then H^+) $\rightarrow C_6H_5COOH$. [½]
(ii) $CH_3COONa + NaOH$ (CaO, heat) $\rightarrow CH_4 + Na_2CO_3$. [1] $2CH_3COONa + 2H_2O$ (electrolysis) $\rightarrow CH_3CH_3 + 2CO_2 + 2NaOH + H_2$. [1]
OR (b) (i) Carboxylic acids form strong intermolecular hydrogen bonds, existing as dimers even in the vapour, so more energy is needed to separate the molecules. [1]
(ii) (I) $CH_3COOH + PCl_5 \rightarrow CH_3COCl + POCl_3 + HCl$. [1] (II) $2CH_3COOH$ (P_2O_5, heat) $\rightarrow (CH_3CO)_2O + H_2O$. [1] (III) $CH_3COOH + 4[H]$ ($LiAlH_4$, then H_2O) $\rightarrow CH_3CH_2OH + H_2O$. [1] (IV) $CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$ (conc. H_2SO_4). [1]

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