CLASS 12 | CHEMISTRY | EXTRA QUESTIONS

Class 12 Chemistry Chapter 8 Aldehydes, Ketones and Carboxylic Acids – Extra Questions with Answers

These extra practice questions for Class 12 Chemistry Chapter 8 – Aldehydes, Ketones and Carboxylic Acids go beyond the NCERT textbook exercises to reinforce nomenclature, name reactions, and the distinguishing tests for carbonyl and carboxyl compounds. Useful for board exam revision and quick concept checks.

Contents

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Very Short Answer Type Questions (1 Mark)

Q1. Name the reagent used to reduce an acid chloride to an aldehyde without over-reduction to the alcohol.
Ans: **H_2/Pd–$BaSO_4$ (poisoned catalyst)** — the **Rosenmund reduction**. The poisoned palladium catalyst stops the reduction at the aldehyde stage.

Q2. Which of formaldehyde, acetaldehyde and benzaldehyde undergo the Cannizzaro reaction, and why?
Ans: **All three except acetaldehyde.** Cannizzaro requires an aldehyde with **no α-hydrogen**; formaldehyde has no carbon at all attached to –CHO, and benzaldehyde's carbonyl carbon is attached to the aromatic ring rather than a CH group, so neither has α-hydrogens. Acetaldehyde (CH_3CHO) does have α-hydrogens and undergoes aldol condensation instead.

Q3. Name the test used to distinguish a methyl ketone from other ketones.
Ans: The **iodoform test** (I_2/NaOH) — only compounds with a CH_3CO– group (or oxidisable to one) give the characteristic yellow precipitate of iodoform (CHI_3).

Q4. Arrange in increasing order of acid strength: formic acid, acetic acid, chloroacetic acid.
Ans: **Acetic acid<formic acid<chloroacetic acid**. Formic acid (HCOOH) has no electron-donating alkyl group, so it is more acidic than acetic acid; chloroacetic acid's electron-withdrawing –Cl (–I effect) makes it the strongest of the three.

Short Answer Type Questions (2–3 Marks)

Q5. Why is the boiling point of carboxylic acids higher than that of alcohols of comparable molecular mass?
Ans: Carboxylic acids exist largely as **hydrogen-bonded dimers** in the liquid and vapour phase (two molecules linked by a pair of O–H···O=C hydrogen bonds), which effectively doubles the molecular mass being vaporised and requires substantially more energy to separate than the single hydrogen bonds available to an alcohol.

Q6. Explain why aldehydes are generally more reactive than ketones towards nucleophilic addition reactions, both electronically and sterically.
Ans: **Electronically,** a ketone has two electron-donating alkyl/aryl groups reducing the electrophilicity of the carbonyl carbon, whereas an aldehyde has only one (plus a hydrogen), leaving its carbonyl carbon more electron-deficient and reactive. **Sterically,** the smaller hydrogen atom in an aldehyde offers far less hindrance to an approaching nucleophile than the second bulky alkyl/aryl group present in a ketone.

Q7. Explain why carboxylic acids do not give the characteristic reactions of the carbonyl group (e.g. they do not form 2,4-DNP derivatives or oxime/cyanohydrins in the way aldehydes and ketones do).
Ans: In a carboxylic acid, the –OH group's lone pair is **delocalised into the carbonyl by resonance**, reducing the electrophilicity of the carbonyl carbon considerably compared to a simple aldehyde or ketone. This resonance donation makes the carboxyl carbon far less susceptible to nucleophilic attack, so carboxylic acids do not undergo the typical carbonyl-addition reactions (2,4-DNP test, oxime/cyanohydrin

formation) that aldehydes and ketones give.

Higher Order Thinking Skills (HOTS)

Q8. Two isomeric ketones, pentan-2-one and pentan-3-one, are treated separately with the iodoform reagent (I_2/NaOH). Predict the outcome for each and explain the structural basis for the difference.
Ans: **Pentan-2-one ($CH_3–CO–CH_2CH_2CH_3$) gives a positive iodoform test** (yellow CHI_3 precipitate), since it has the required $CH_3–CO–$ (methyl ketone) grouping that undergoes exhaustive iodination followed by cleavage. **Pentan-3-one ($CH_3CH_2–CO–CH_2CH_3$) gives a negative test**, since neither group attached to its carbonyl carbon is a methyl group — both are ethyl groups, so the essential $CH_3CO–$ pattern required for iodoform formation is absent.

Q9. A student proposes that benzoic acid should be a weaker acid than acetic acid, reasoning that the aromatic ring donates electron density into the carboxyl group by resonance, the same way it stabilises phenoxide. Explain why this reasoning is flawed, given that benzoic acid ($pK_a \approx 4.2$) is in fact slightly stronger than acetic acid ($pK_a \approx 4.76$).
Ans: The student's analogy is flawed because in **benzoic acid**, the ring is attached directly to the carboxyl **carbon** (not to an oxygen, as in phenol), so there is no lone pair on the ring able to donate directly into the C=O the way phenol's oxygen lone pair donates into its ring. Instead, the ring acts as a weakly electron-withdrawing (net –I, with the sp^2 ring carbon more electronegative than an sp^3 alkyl carbon) substituent relative to the electron-donating methyl group of acetic acid, which stabilises the carboxylate slightly better and makes benzoic acid marginally the stronger acid.

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