▶ Video explanation (YouTube Short)

Uses of Aldehydes and Ketones

Aldehydes and ketones are used as solvents, as starting materials for other chemicals, and for their smells and flavours. Most uses come from one group: the polar **C=O**.

1. The uses at a glance (NCERT 8.5)

Compound	Use	Why it works
Formaldehyde, HCHO (formalin = ~40% solution in water)	preserving biological specimens; Bakelite; urea–formaldehyde glues and other polymers	the most reactive carbonyl compound: no alkyl group donates electrons to, or crowds, its C=O carbon
Acetaldehyde, CH_3CHO	starting material for acetic acid, ethyl acetate, vinyl acetate, polymers and drugs	oxidation of –CHO gives –COOH
Acetone, CH_3COCH_3; ethyl methyl ketone	common industrial solvents; acetone is in nail-polish remover	polar C=O (O δ^-, C δ^+) plus non-polar CH_3 groups: mixes with water and dissolves oils, paints and grease
Benzaldehyde, C_6H_5CHO	perfumery and dyes (almond odour)	aromatic aldehyde
Vanillin; cinnamaldehyde	flavours: vanilla; cinnamon	each carries a benzene ring and a –CHO group

Other well-known odours and flavours: butyraldehyde, acetophenone, camphor.

2. Why formalin preserves specimens

Formaldehyde reacts with the $–NH_2$ groups of proteins and joins protein chains through $–CH_2–$ bridges. The tissue becomes firm ("fixed") and microbes cannot decompose it; formaldehyde also kills microbes.

3. Bakelite: the first step, with curved arrows

In base, phenol becomes phenoxide ($C_6H_5O^-$). (1) A lone pair on O^- moves into the ring. (2) The ring's C=C π bond next to the O (the ortho carbon) attacks the carbon of HCHO. (3) The C=O π pair of HCHO moves onto its oxygen. After proton transfers the ring carries a $–CH_2OH$ group (o-hydroxymethylphenol). Repeated reactions join rings by $–CH_2–$ bridges into a hard, cross-linked plastic: Bakelite (switches, handles).

Solved example

Q. Acetone dissolves nail polish and also mixes completely with water. Explain.
A. Its C=O group is polar (O δ^-, C δ^+), so it mixes with water (and accepts hydrogen bonds from it). Its two CH_3 groups are non-polar, so it also dissolves non-polar substances such as the resins and oils in nail polish.

Key takeaways

- Formaldehyde: formalin (preserving), Bakelite, urea–formaldehyde glues.
- Acetaldehyde: the starting material for acetic acid, ethyl acetate and polymers.
- Acetone and ethyl methyl ketone: solvents.
- Benzaldehyde, vanillin, cinnamaldehyde: odours and flavours (benzene ring + CHO).
- One C=O group: from smells to plastics.

Practice questions

1. (MCQ) Formalin is an aqueous solution of about 40%: (a) acetaldehyde (b) formaldehyde (c) acetone (d) methanol
2. (MCQ) Bakelite is made from phenol and: (a) acetone (b) acetaldehyde (c) formaldehyde (d) benzaldehyde
3. (MCQ) The flavouring compound of vanilla is: (a) cinnamaldehyde (b) benzaldehyde (c) vanillin (d) acetophenone
4. (Very short) Name two ketones used as industrial solvents.
5. (Very short) Which acid is made on a large scale by oxidising acetaldehyde?
6. (Short) Why is formaldehyde more reactive towards nucleophiles than acetone?
7. (Short) What is common to the structures of vanillin, cinnamaldehyde and benzaldehyde?
8. (Application) In the first step of Bakelite formation, which carbon of phenoxide bonds to the carbon of HCHO, and where does the C=O π electron pair go?

Answer key

1. (b) formaldehyde.
2. (c) formaldehyde.
3. (c) vanillin.
4. Acetone and ethyl methyl ketone (butanone).
5. Acetic (ethanoic) acid.
6. HCHO has no alkyl groups: nothing pushes electrons into its C=O carbon (it stays more δ+) and nothing crowds it, so a nucleophile reaches it easily. Acetone's two CH_3 groups do both.
7. Each has a benzene ring carrying a –CHO group.
8. The ortho carbon (next to the C–O^-), using the ring's C=C π electrons; the C=O π pair moves onto the oxygen of HCHO, which becomes O^- (later –OH).

▶ Watch the video explanation