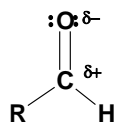


Aldehydes

An aldehyde is an organic compound containing a terminal carbonyl group.



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- The functional group, consists of a carbon atom bonded to a hydrogen atom and double-bonded to an oxygen atom.
- The aldehyde group is also called the formyl or methanoyl group.

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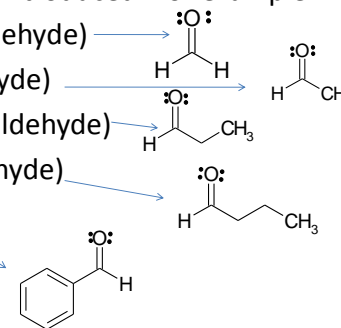
IUPAC nomenclature for aldehydes

- Simply replace the -e of alkane with -al.
- For example :
 - Methanal
 - Ethanal
 - Propanal
 - Butanal etc

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Common names of aldehydes

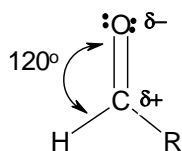
- Some aldehydes were known before the IUPAC nomenclature was introduced. For example:
- Methanal (Formaldehyde)
- Ethanal (Acetaldehyde)
- Propanal (Propionaldehyde)
- Butanal (butyraldehyde)
- Benzaldehyde



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Properties of Aldehydes: Boiling point

- The aldehyde group is polar.
- Oxygen, more electronegative than carbon, pulls the electrons in the carbon-oxygen bond towards itself, creating an electron deficiency at the carbon atom.



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Properties of Aldehydes: Boiling point

- The polar carbonyl group makes aldehydes polar compounds, and hence they have higher boiling points than nonpolar compounds of comparable molecular weight.
- Boiling point is higher than the corresponding alkane, but not as high as the alcohol.
- Boiling point increases with increasing Molecular Weight

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Properties of Aldehydes: Boiling point

Compound	MP °C	BP °C
Formaldehyde	-92	-21
Acetaldehyde	-125	21
Propanal	-81	49
Butanal	-99	76
Pentanal	-91.5	102
Hexanal	-56	128
Benzaldehyde	57	178

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Properties of Aldehydes: Solubility

- Methanal HCHO is a gas, the rest are colourless liquids. The simpler members are soluble in water.
- The lighter aldehydes are very soluble in water, with solubility decreasing with increasing Molecular Weight.

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Uses of Aldehyde compounds

- Aldehydes are used to make carboxylic acids.
- Methanal (the simplest aldehyde) is used to preserve biological specimens.
- Aldehydes play an important role in the manufacture of plastics. Urea-methanal is produced by condensation polymerization between urea and methanal under heat and pressure.

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Important Aldehydes: Methanal

- It is also known as formaldehyde
- Molecular formula: CH_2O
- Molar mass: $30.03 \text{ g}\cdot\text{mol}^{-1}$
- Appearance: colorless gas
- Density: $1 \text{ kg}\cdot\text{m}^{-3}$, gas
- Melting point: $-117 \text{ }^\circ\text{C}$
- Boiling point: $-19.3 \text{ }^\circ\text{C}$
- Solubility in water: $> 100 \text{ g}/100 \text{ ml}$ ($20 \text{ }^\circ\text{C}$)



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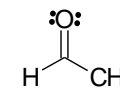
Important Aldehydes: Methanal

- Aqueous solutions of methanal are referred to as formalin.
- Methanal is produced industrially by the catalytic oxidation of methanol.
 - Industrial applications of formaldehyde:
 - It is a common building block for the synthesis of more complex compounds and materials.
 - As a disinfectant and biocide. It is also used as a preservative in vaccines.

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Important Aldehydes: Ethanal

- It is also known as acetaldehyde.
- It is a flammable liquid with a fruity smell. Acetaldehyde occurs naturally in ripe fruit, coffee, and fresh bread, and is produced by plants as part of their normal metabolism.
- It is popularly known as a chemical that causes hangovers.



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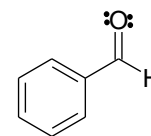
Important Aldehydes: Ethanal

- Appearance: Colorless liquid Pungent, fruity odor Density: 0.788 g cm^{-3}
- Melting point: $-123.5 \text{ }^\circ\text{C}$ (139.5 K)
- Boiling point: $20.2 \text{ }^\circ\text{C}$ (293.2 K)
- Solubility in water: soluble in all proportions

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Important Aldehydes: Benzaldehyde

- **Benzaldehyde** ($\text{C}_6\text{H}_5\text{CHO}$) is an aromatic aldehyde consisting of a benzene ring with an aldehyde substituent.
- At room temperature it is a colorless liquid with a characteristic and pleasant almond-like odor.



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Important Aldehydes: Benzaldehyde

- Density: 1.0415 g/ml , liquid
- Melting point: $-26 \text{ }^\circ\text{C}$
- Boiling point: $178.1 \text{ }^\circ\text{C}$
- Solubility in water: Slightly soluble (0.6 w/v at $20 \text{ }^\circ\text{C}$)

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Uses of Benzaldehyde

- It is commonly employed as a commercial food flavorant (almond flavor)
- An industrial solvent
- It is used chiefly in the synthesis of other organic compounds, ranging from pharmaceuticals to plastic additives.
- It is also an important intermediate for the processing of perfume and flavoring compounds and in the preparation of certain dyes containing nitrogen.

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