

HOMOLOGOUS SERIES

Definition:

A homologous series is a series of compounds with similar chemical properties and some functional groups differing from the successive member by CH_2 . Carbon chains of varying lengths have been observed in organic compounds having the same general formula.

| S.No. | Name of series | General formula | I-homologue | II-homologue |
|-------|-----------------|--|---|---|
| 1. | Alkane | $\text{C}_n\text{H}_{2n+2}$ | CH_4 | CH_3-CH_3 |
| 2. | Alkene | C_nH_{2n} | $\text{CH}_2=\text{CH}_2$ | $\text{CH}_2=\text{CH}-\text{CH}_3$ |
| 3. | Alkyne | $\text{C}_n\text{H}_{2n-2}$ | $\text{HC}\equiv\text{CH}$ | $\text{HC}\equiv\text{C}-\text{CH}_3$ |
| 4. | Halo alkane | $\text{C}_n\text{H}_{2n+1}\text{X}$ | CH_3-X | $\text{CH}_3-\text{CH}_2-\text{X}$ |
| 5. | Alcohol | $\text{C}_n\text{H}_{2n+2}\text{O}$ | CH_3-OH | $\text{CH}_3-\text{CH}_2-\text{OH}$ |
| 6. | Ether | $\text{C}_n\text{H}_{2n+2}\text{O}$ | $\text{CH}_3-\text{O}-\text{CH}_3$ | $\text{CH}_3-\text{O}-\text{CH}_2-\text{CH}_3$ |
| 7. | Aldehyde | $\text{C}_n\text{H}_{2n}\text{O}$ | $\text{H}-\text{CHO}$ | CH_3-CHO |
| 8. | Ketone | $\text{C}_n\text{H}_{2n}\text{O}$ | $\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$ | $\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$ |
| 9. | Carboxylic acid | $\text{C}_n\text{H}_{2n}\text{O}_2$ | $\text{H}-\text{COOH}$ | CH_3-COOH |
| 10. | Ester | $\text{C}_n\text{H}_{2n}\text{O}_2$ | $\begin{array}{c} \text{H}-\text{C}-\text{O}-\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$ | $\begin{array}{c} \text{H}-\text{C}-\text{O}-\text{CH}_2\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$ or $\begin{array}{c} \text{CH}_3-\text{C}-\text{O}-\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$ |
| 11. | Amide | $\text{C}_n\text{H}_{2n+1}\text{NO}$ | $\text{H}-\text{CONH}_2$ | $\text{CH}_3-\text{CONH}_2$ |
| 12. | Nitro alkane | $\text{C}_n\text{H}_{2n+1}\text{NO}_2$ | $\begin{array}{c} \text{O} \\ \nearrow \\ \text{CH}_3-\text{N} \\ \searrow \\ \text{O} \end{array}$ | $\begin{array}{c} \text{O} \\ \nearrow \\ \text{CH}_3-\text{CH}_2-\text{N} \\ \searrow \\ \text{O} \end{array}$ |
| 13. | Amine | $\text{C}_n\text{H}_{2n+3}\text{N}$ | CH_3-NH_2 | $\text{CH}_3-\text{CH}_2-\text{NH}_2$ |

Characteristics of homologous series of organic compounds

1. The functional group of the members of the homologous series is the same.
2. The general formula is the same for all members.
3. Members have nearly identical chemical properties due to the same functional group.
4. Members have a general method of preparation in common.

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Common Question in Homologous series:

Why is the first molecular formula of ketone is Propanone not methanone

The functional group ketone is said to have one carbonyl group lies between two carbon atoms. Hence the first member of the functional group ketone must have three carbon atoms. Therefore the first member of the ketone is propanone.

How do you determine whether a series is homologous?

Each successive member differs from the others by a CH_2 unit. For example, the difference between CH_4 and C_2H_6 is $-\text{CH}_2$ unit, and the difference between C_4H_{10} and C_3H_8 is also $-\text{CH}_2$ unit. As a result, CH_4 , C_2H_6 , and C_3H_8 are homologs.

Why are the chemical properties of homologous series always the same?

In organic chemistry, homologous series are groups of molecules that only differ in the number of methylene (CH_2) groups. Because they share the same functional group, homologous series have similar chemical properties.

What are the two main distinctions between any two groups of homologous series?

The two main differences are as follows-

In terms of molecular mass, the difference in the molecular formula of any two adjacent homologous is 14 a.m.u.

It is distinguished by three atoms. It has one carbon and two hydrogen atoms that are different.

What are individual members of the homologous series called?

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Individual members of such a series are known as homologous, and the phenomenon is known as homology.



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