

# CAIE Chemistry A-level

## 29: An Introduction to Organic Chemistry

(A-level only)

Definitions

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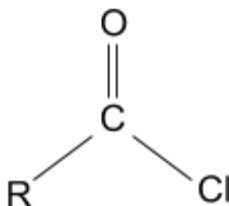




## Definitions and Concepts for CAIE Chemistry A-level

### An introduction to A Level Organic Chemistry

**Acyl chloride:** A compound containing the functional group  $\text{COCl}$ . Acyl chlorides are a derivative of carboxylic acids, but the  $-\text{OH}$  is substituted by  $-\text{Cl}$ .



**Aliphatic:** A molecule that only contains straight or branched alkyl chains.

**Amines:** Compounds that contain the  $\text{NR}_3$  functional group (where R could be hydrogen atoms or alkyl chains). Amines are basic as the nitrogen atom has a lone pair of electrons that can accept a proton. In a reaction between amines and dilute acids, salts are formed.

**Amino acid:** An organic compound containing both a carboxyl group ( $-\text{COOH}$ ) and an amino group ( $-\text{NH}_2$ ).

**$\alpha$ -Amino acid:** A compound with the general formula  $\text{RCH}(\text{NH}_2)\text{COOH}$ , where an amino group and a carboxylic acid group are bonded to the same carbon atom. The carboxylic acid group of an amino acid can react with alkalis or can be used to form esters. The amine group of an amino acid can react with acids.

**Aromatic compound/Arene:** A compound containing at least one benzene ring.

**Benzene:** A 6-membered carbon ring ( $\text{C}_6\text{H}_6$ ) containing a delocalised  $\pi$  system. Benzene has a planar structure and an intermediate bond length between a single and double bond. Delocalisation of the p electrons into the  $\pi$  system makes benzene more stable than expected.

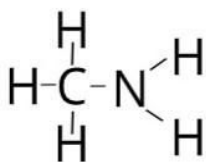
**Chiral centre:** A carbon atom that is bonded to 4 different groups.

**Delocalisation of p electrons:** In benzene, the empty p orbital on each carbon atom overlaps with the others to form a delocalised  $\pi$  system that contains 6 electrons.





**Displayed formula:** A type of formula that shows all the bonds between every atom in the compound. E.g.



**Electrophile:** An electron pair acceptor.

**Electrophilic substitution:** A reaction in which an electrophile replaces an atom/group of atoms in a compound.

**Empirical formula:** Smallest whole number ratio of atoms of each element in a compound. For example, the empirical formula of benzene ( $C_6H_6$ ), cyclobutadiene ( $C_4H_4$ ) and acetylene ( $C_2H_2$ ) are all "CH".

**Enantiomers:** Molecules that are non-superimposable mirror images of one another. A pair of enantiomers have opposite effects on plane-polarised light.

**Functional group:** An atom/group of atoms responsible for the characteristic reactions of a compound.

**General formula:** A type of empirical formula that represents the composition of any member of an entire class of compounds. For example, alkanes all have the general formula  $C_nH_{2n+2}$ .

**Halogenoarene:** A molecule with a benzene ring directly attached to a halogen atom.

**Hybridisation:** The combining of two or more atomic orbitals to form new 'hybrid' orbitals which are different to the originals.

**Nomenclature:** The naming system for compounds.

**Nucleophilic addition-elimination:** A reaction in which a nucleophile is added to a molecule by breaking a  $\pi$  bond then a leaving group is removed to reform the  $\pi$  bond.

**Optical isomerism:** A type of stereoisomerism present in compounds that are non-superimposable mirror images of one another caused by the presence of a chiral centre. They have the same molecular formula with different arrangements of atoms in space.

**Organic molecules:** These molecules contain carbon and hydrogen atoms but often also include additional elements like oxygen and nitrogen.

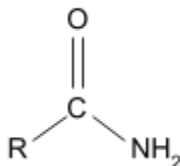




**Racemic mixture (racemate):** A mixture containing equal amounts of enantiomers, a 50:50 mix of a pair of enantiomers.

**Phenol:** Phenol is an aromatic ring with an OH group attached.

**Primary amide:** A molecule containing the functional group  $\text{-CONH}_2$ , as shown below.

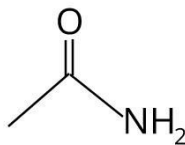


**Primary amine:** An organic compound that contains the functional group  $\text{RNH}_2$  (where R is an alkyl chain).

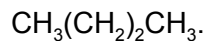
**Secondary amide:** An organic compound that contains the functional group  $\text{-CONHR}$  (where R is an alkyl chain).

**Secondary amine:** An organic compound that contains the functional group  $\text{R}_2\text{NH}$  (where R is an alkyl chain).

**Skeletal formula:** A representation of an organic compound in which lines represent bonds between atoms and atoms are represented by their symbol. Hydrogens are assumed to be at the end of the line if no other atomic symbol is present. E.g:



**Structural formula:** Shows the arrangement of atoms in a molecule. E.g. Butane:



**Synthesis:** The process of combining different elements and compounds to build new molecules.

**Tertiary amide:** An organic compound that contains the functional group  $\text{-CONR}_2$  (where R is an alkyl chain).

**Tertiary amine:** An organic compound that contains the functional group  $\text{R}_3\text{N}$  (where R is an alkyl chain).



**$\pi$ -bond:** A type of covalent bond formed when adjacent p orbitals overlap above and below the  $\sigma$  single carbon bond. Pi ( $\pi$ ) bonds can't be rotated. As  $\pi$ -bonds have low bond enthalpy, alkenes are more reactive than alkanes.

**$\sigma$ -bond:** A type of covalent bond formed by the direct overlap of orbitals between the bonding atoms to form a single carbon bond. These have a high bond enthalpy.

