

# CAIE Chemistry A-level

## Topic 29 - An Introduction to Organic Chemistry

### (A level only)

### Flashcards

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# What is an arene?



# What is an arene?

An arene is an aromatic hydrocarbon.

This means it contains a benzene ring.

Prefix: phenoyl- OR suffix: -benzene.



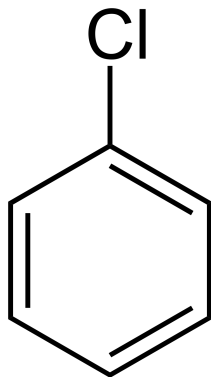
# What is a halogenoarene?



# What is a halogenoarene?

A halogenoarene is an aromatic hydrocarbon whereby one or more hydrogen atoms bonded to the aromatic ring are replaced by a halogen atom.

E.g. Chlorobenzene:



# What is a phenol?

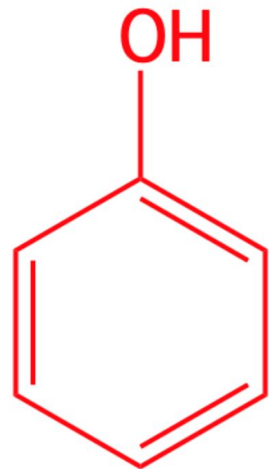


## What is a phenol?

A phenyl group ( $-\text{C}_6\text{H}_5$ ) bonded to a hydroxyl group ( $-\text{OH}$ ).

Phenol has the molecular formula  $\text{C}_6\text{H}_5\text{OH}$ .

Suffix: -phenol / -benzenol.



What is an acyl chloride? Draw the functional group

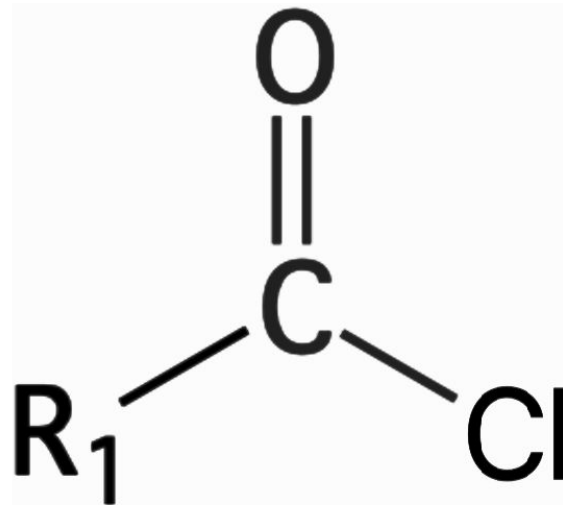




# What is an acyl chloride? Draw the functional group

A carboxylic acid derivative where the -OH group in -COOH has been replaced with a chlorine atom to form a -COCl group.

Suffix: -oyl chloride.



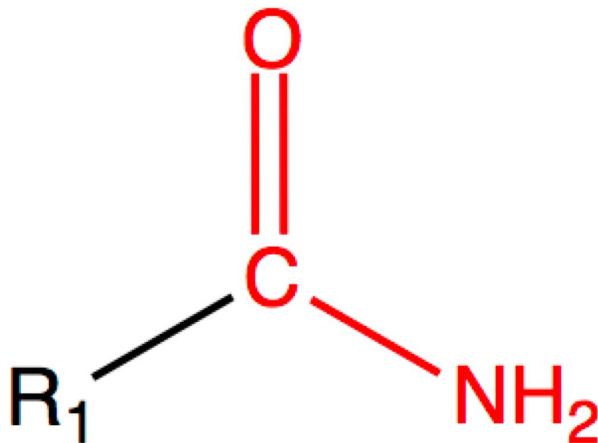
# What is an amide?



# What is an amide?

Formed from the condensation reaction between a carboxylic acid and an amine functional group.

Suffix: -amide



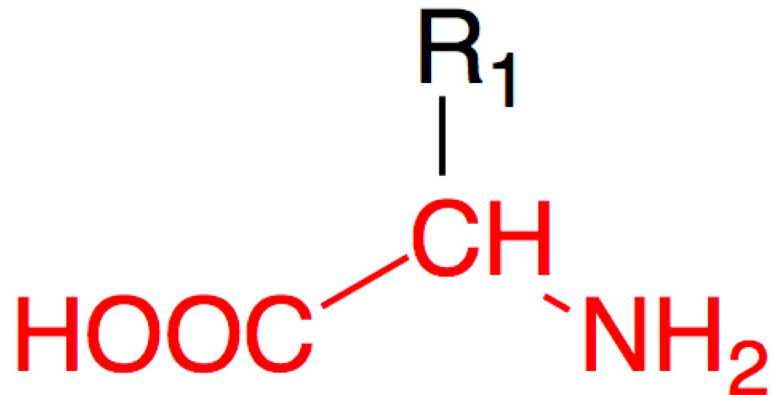
# What is an amino acid?



# What is an amino acid?

An amino acid is an organic compound that has both a carboxylic acid and amine functional group. In an alpha-amino acid, both groups are attached to the same carbon atom.

Naming: Amino- -oic acid.



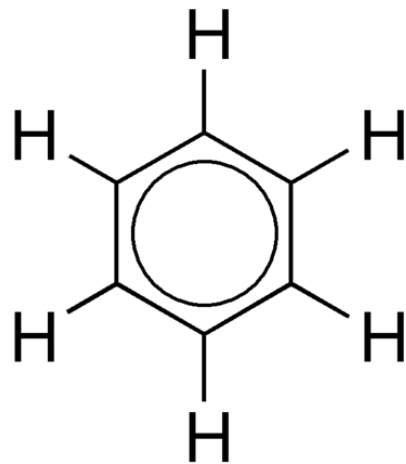
# What is benzene?



# What is benzene?

Benzene is an aromatic hydrocarbon.

Molecular formula:  $C_6H_6$

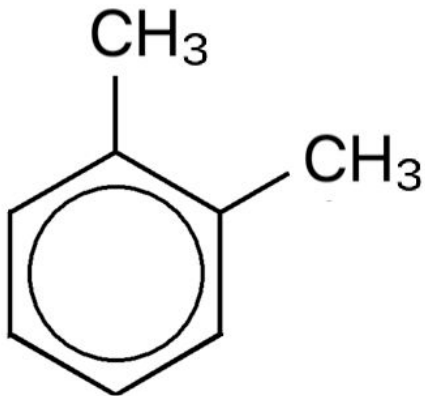


Draw and name the different structural isomers of dimethylbenzene

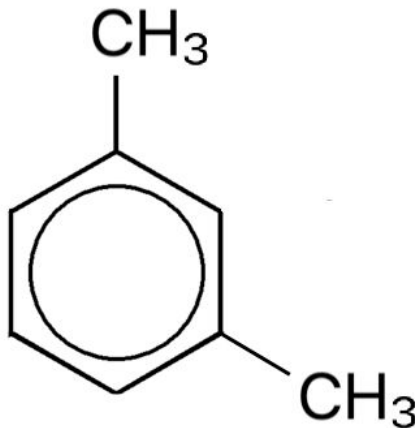




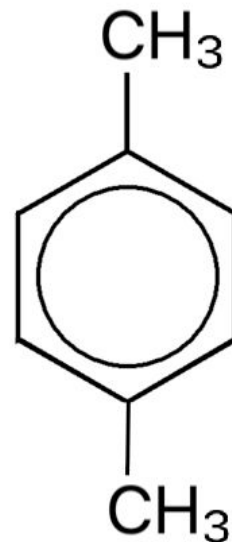
Draw and name the different structural isomers of dimethylbenzene



1,2-dimethylbenzene



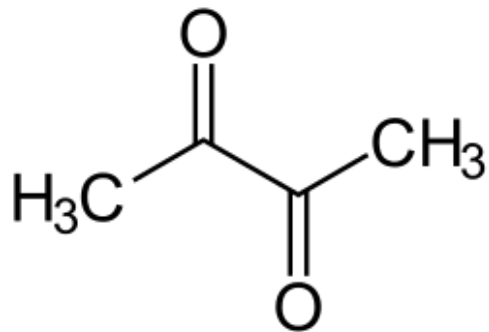
1,3-dimethylbenzene



1,4-dimethylbenzene



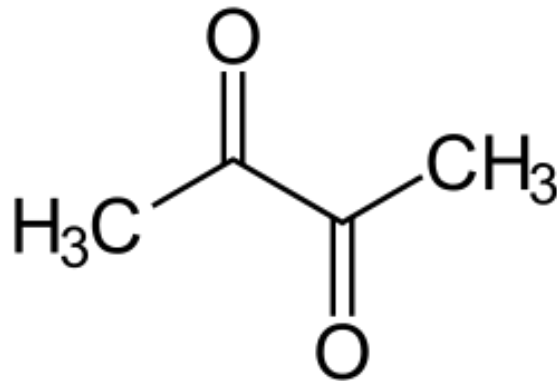
What is the molecular formula and empirical formula of the compound below?



What is the molecular formula and empirical formula of the compound below?

Molecular formula:  $C_4H_6O_2$

Empirical formula:  $C_2H_3O$



Describe the shape and bond angle of benzene



Describe the shape and bond angle of benzene

Planar,  $120^\circ$



# Describe the bonding in benzene



## Describe the bonding in benzene

- Each carbon atom uses two electrons to form sigma bonds with the adjacent carbon atoms. One electron is used to form a sigma bond with a hydrogen atom.
- The remaining electron on each carbon atom is delocalised into the middle of the ring to form a delocalised  $\pi$  electron system (an area of high electron density).



What causes optical isomerism? What are optical isomers?





# What causes optical isomerism? What are optical isomers?

- Optical isomerism is a type of stereoisomerism found in molecules that contain a chiral centre.
- Optical isomers or *enantiomers* are non-superimposable, mirror images of each other.



# What is a chiral centre?



## What is a chiral centre?

In organic chemistry, a chiral centre is in the form of a carbon atom bonded to four different groups. Compounds may contain more than one chiral centre.



# What is a chiral molecule?



## What is a chiral molecule?

A molecule containing one or more chiral centres. It has no planes of symmetry.



How can two optical isomers be told apart?



# How can two optical isomers be told apart?

Two optical isomers have exactly the same physical properties except the fact they rotate plane polarised light in opposite directions.

Optical isomers may also react differently in the human body.



What is a racemic mixture? What effect does a racemic mixture have on plane polarised light?





What is a racemic mixture? What effect does a racemic mix have on plane polarised light?

An equal 50:50 mixture of optical isomers is called a racemic mixture (racemate). These mixtures have no effect on plane polarised light as enantiomers rotate the light equally in opposite directions - there is no net rotation.

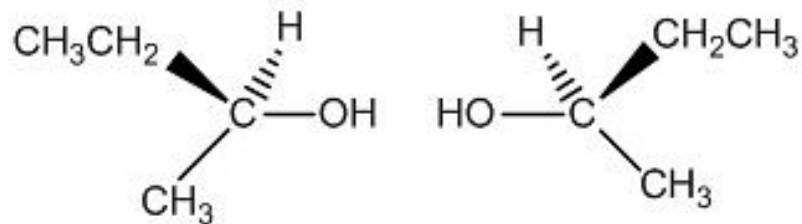


Draw diagrams to show the optical isomers of butan-2-ol. Why can butan-2-ol form optical isomers?



Draw diagrams to show the optical isomers of butan-2-ol. Why can butan-2-ol form optical isomers?

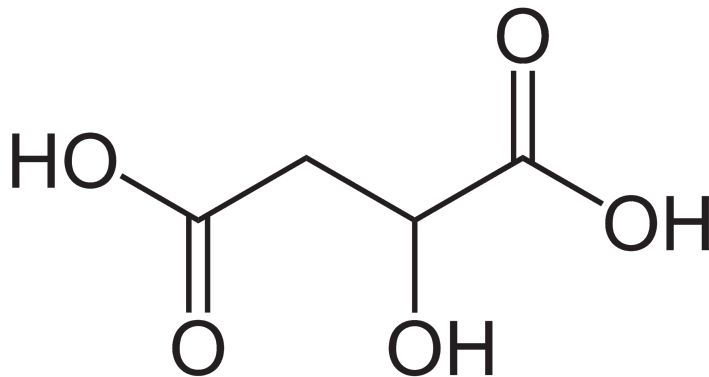
Optical isomers:



The central carbon in the diagrams is chiral because it is attached to four different groups:  $-\text{OH}$ ,  $-\text{CH}_3$ ,  $-\text{H}$ , and  $-\text{CH}_2\text{CH}_3$ . The two isomers are non-superimposable mirror images of each other.



Identify the chiral centre in the molecule below



# Identify the chiral centre in the molecule below

This carbon is chiral as it is bonded to 4 different groups: -H, -OH, -COOH, -CH<sub>2</sub>COOH

