

# WJEC (Eduqas) Chemistry AS-level

## Component 2.6 - Halogenoalkanes

### Flashcards

This work by [PMT Education](https://www.pmt.education) is licensed under [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)



# What are halogenoalkanes?



# What are halogenoalkanes?

Halogenoalkanes are organic compounds where at least one hydrogen atom on an alkane has been replaced by a halogen.



# What is a nucleophile?



# What is a nucleophile?

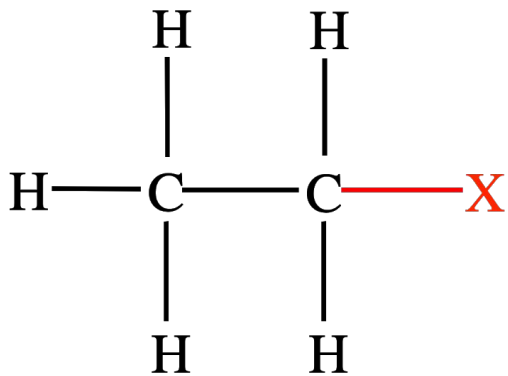
A nucleophile is a species that donates a lone pair of electrons in a reaction.



What do the displayed, structural and skeletal formulae of the halogenoalkane with the molecular formula  $C_2H_5X$  look like?



What do the displayed, structural and skeletal formulae of the halogenoalkane with the molecular formula  $C_2H_5X$  look like?



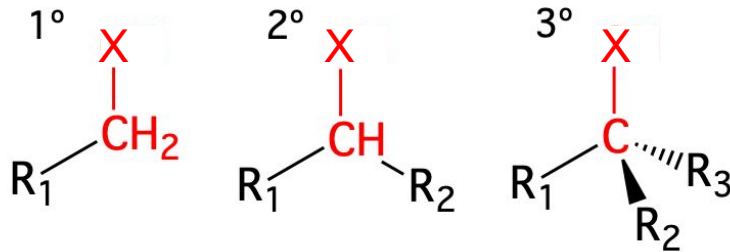
What is the difference between primary, secondary and tertiary halogenoalkanes?





# What is the difference between primary, secondary and tertiary haloalkanes?

Primary haloalkanes have only one alkyl group attached to the carbon to which the halogen is bonded, secondary haloalkanes have two and tertiary have three.



What is formed when a halogenoalkane reacts with an aqueous alkali, like KOH?



What is formed when a halogenoalkane reacts with an aqueous alkali, like KOH?

An alcohol is formed.

The  $\text{OH}^-$  ion acts as a nucleophile.



What is formed when a halogenoalkane reacts with ethanolic potassium hydroxide? What type of reaction takes place?



What is formed when a halogenoalkane reacts with ethanolic potassium hydroxide? What type of reaction takes place?

An alkene is produced.

It is an elimination reaction.



What is formed when a halogenoalkane reacts with alcoholic ammonia under pressure?



What is formed when a halogenoalkane reacts with alcoholic ammonia under pressure?

An amine is produced.

Ammonia acts as the nucleophile.



What is formed when a halogenoalkane reacts with alcoholic potassium cyanide?





What is formed when a halogenoalkane reacts with alcoholic potassium cyanide?

A nitrile is produced.

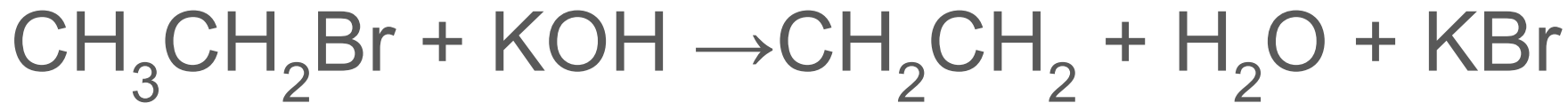
The cyanide ion acts as the nucleophile.



Write the chemical equation for the reaction between bromoethane and ethanolic potassium hydroxide



Write the chemical equation for the reaction between bromoethane and ethanolic potassium hydroxide



What reaction can be carried out to increase the number of carbons in the halogenoalkane chain?



What reaction can be carried out to increase the number of carbons in the halogenoalkane chain?

Nucleophilic substitution of the halogenoalkane with a cyanide ion in alcoholic conditions.

The cyanide ion,  $\text{CN}^-$ , contains a carbon atom so the carbon chain increases by one unit.



How can halogenoalkanes be qualitatively identified?



# How can halogenoalkanes be qualitatively identified?

Add ethanol, followed by aqueous silver nitrate solution to the halogenoalkane. If a halogenoalkane is present then a silver halide precipitate will form in the solution.



What colour precipitate will form when chloroethane is added to silver nitrate?





What colour precipitate will form when chloroethane is added to silver nitrate?

AgCl - White precipitate



What colour precipitate will form when bromoethane is added to silver nitrate?



What colour precipitate will form when bromoethane is added to silver nitrate?

AgBr - Cream precipitate



What colour precipitate will form when iodoethane is added to silver nitrate?



What colour precipitate will form when iodoethane is added to silver nitrate?

AgI - Yellow precipitate



What is the name of the mechanism for the reaction between a halogenoalkane and ammonia?



What is the name of the mechanism for the reaction between a halogenoalkane and ammonia?

Nucleophilic substitution



What is the condition required for a halogenoalkane to produce an alcohol rather than an alkene when it reacts with KOH?





What is the condition required for a halogenoalkane to produce an alcohol rather than an alkene when it reacts with KOH?

The KOH needs to be aqueous.

If the KOH is ethanolic, an alkene will be produced.



What is the trend in reactivity of primary, secondary and tertiary halogenoalkanes?



What is the trend in reactivity of primary, secondary and tertiary halogenoalkanes?

Tertiary > Secondary > Primary

The tertiary halogenoalkane is the most reactive and the primary halogenoalkane is the least reactive.



What is the trend in reactivity of chloro-, bromo- and iodo- halogenoalkanes?  
Explain in terms of bond enthalpy



# What is the trend in reactivity of chloro-, bromo- and iodo- halogenoalkanes? Explain in terms of bond enthalpy

iodo- > bromo- > chloro-

Iodo- halogenoalkanes are the most reactive. This is because the C-I bond is the weakest (low bond enthalpy) and so it is broken easily.

Chloro- halogenoalkanes are the least reactive because the C-Cl bond has a high bond enthalpy and therefore requires a lot of energy to break.



What are some common uses of halogenoalkanes?



# What are some common uses of halogenoalkanes?

- Solvents
- Refrigerants
- Anaesthetics



Why are there tight regulations surrounding the use of halogenoalkanes?





Why are there tight regulations surrounding the use of halogenoalkanes?

Halogenoalkanes are toxic and have a negative impact on the environment, so their use is regulated.



# What are CFCs?



# What are CFCs?

Chlorofluorocarbons.

These are organic compounds containing only carbon, chlorine and fluorine atoms.



What is the environmental problem associated with the use of CFCs (chlorofluorocarbons)?



What is the environmental problem associated with the use of CFCs (chlorofluorocarbons)?

CFCs damage the ozone layer. The ozone is in the upper atmosphere and it absorbs a lot of UV radiation.

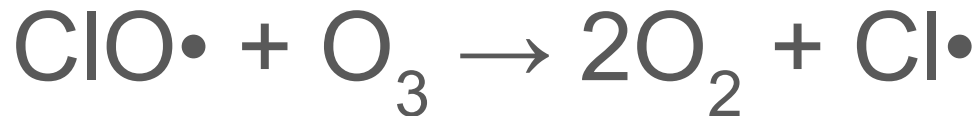
CFCs are broken down by UV light, releasing a chlorine radical. This chlorine radical reacts with ozone and breaks it down to oxygen. This means there is less protection from UV radiation.



Give the equations for the reactions that take place between a chlorine free radical and ozone



Give the equations for the reactions that take place between a chlorine free radical and ozone



Explain the impact of different halogenoalkanes on the atmosphere in reference to the strength of the C-F, C-Cl and C-Br bond





Explain the impact of the bonds C-H, C-F and C-Cl on the atmosphere in reference to the strength of the bond

The C-Cl bond is the weakest of the three bonds so it breaks first. This means the C-Cl bond has the greatest impact on the environment as the free radical is produced most easily. The C-H and C-F bonds are much stronger, with C-F having the highest bond strength.



# What is a reflux setup?



# What is a reflux setup?

Reflux is the boiling setup with a vertical condenser that allows the vapours to return to the same mixture once they condense.

