

# AQA Chemistry A-level

## Topic 3.4 - Alkenes

### Flashcards

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# What is an alkene?



# What is an alkene?

Unsaturated hydrocarbons with a  $C=C$  double bond



# What is the general formula of an alkene?



What is the general formula of an alkene?



Why is there no rotation  
about the C=C double  
bond?



Why is there no rotation about the C=C double bond?

Due to the  $\pi$  (pi) orbital - electron density above and below the single bond, which holds the carbon atoms in place



Are they more or less  
reactive than alkanes?  
Why?





Are they more or less reactive than alkanes? Why?

More reactive, due to high electron density of double bond and the fact the pi-bond is slightly easier to break



# What intermolecular forces of attraction do they have?



What intermolecular forces of attraction do they have?

Only van der Waals due to non-polar bonds



# Are they soluble in water? Why?



Are they soluble in water? Why?

No, non-polar bonds (van der Waals' < hydrogen bonding)



Name and describe the  
three kinds of isomers  
alkenes can have



Name and describe the three kinds of isomers alkenes can have

Chain isomers (branched chains)

Position isomers (C=C on different carbon atom)

Geometric E-Z isomers (Z is when 2 highest atomic number chains are on the same side of the double bond; E is when they're on opposite sides)



Write an equation for the complete combustion of pent-2-ene.





Write an equation for the complete combustion of pent-2-ene.



# What is an electrophile?



# What is an electrophile?

Electron deficient atoms/ions which accept a pair of electrons (here, from the C=C double bond)



What is the most stable type  
of carbocation intermediate?  
why?



What is the most stable kind of carbocation intermediate? Why?

Alkyl groups have a positive inductive effect, so the most stable carbocation is the one bonded to the most other carbon atoms i.e. A tertiary carbocation



Major products will be formed from which kinds of carbocations?



Major products will be formed from which kinds of carbocations?

Tertiary (or the most stable available)



What conditions are needed for the electrophilic addition of  $\text{H}_2\text{O}$  to an alkene?





What conditions are needed for the electrophilic addition of  $\text{H}_2\text{O}$  to an alkene?

Acid catalyst, usually phosphoric acid



What are the product(s) of the reaction?



What are the product(s) of the reaction?

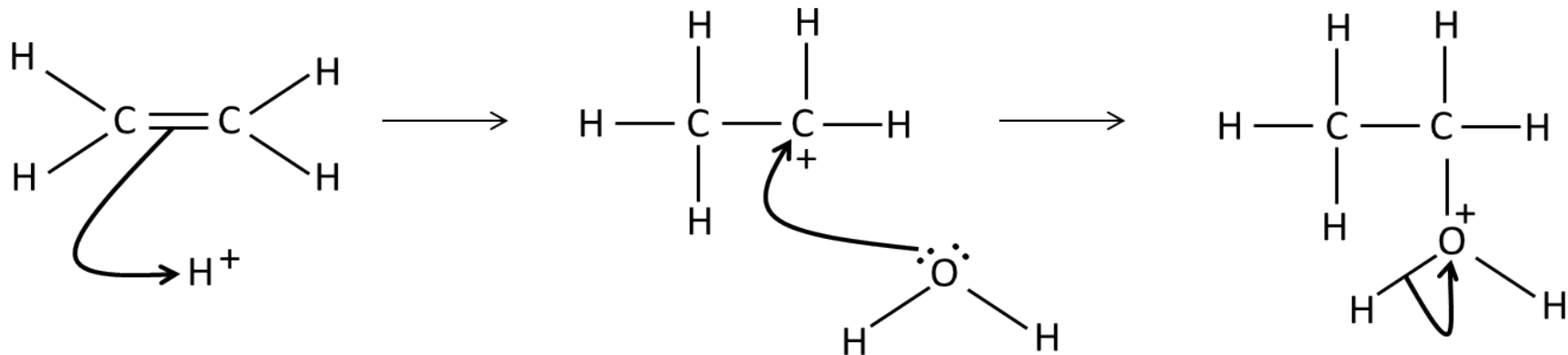
An alcohol



Draw a mechanism for the addition of water to ethene



# Draw a mechanism for the addition of water to ethene



What conditions are needed for the electrophilic addition of a hydrogen halide to an alkene?



What conditions are needed for the electrophilic addition of a hydrogen halide to an alkene?

Room temperature

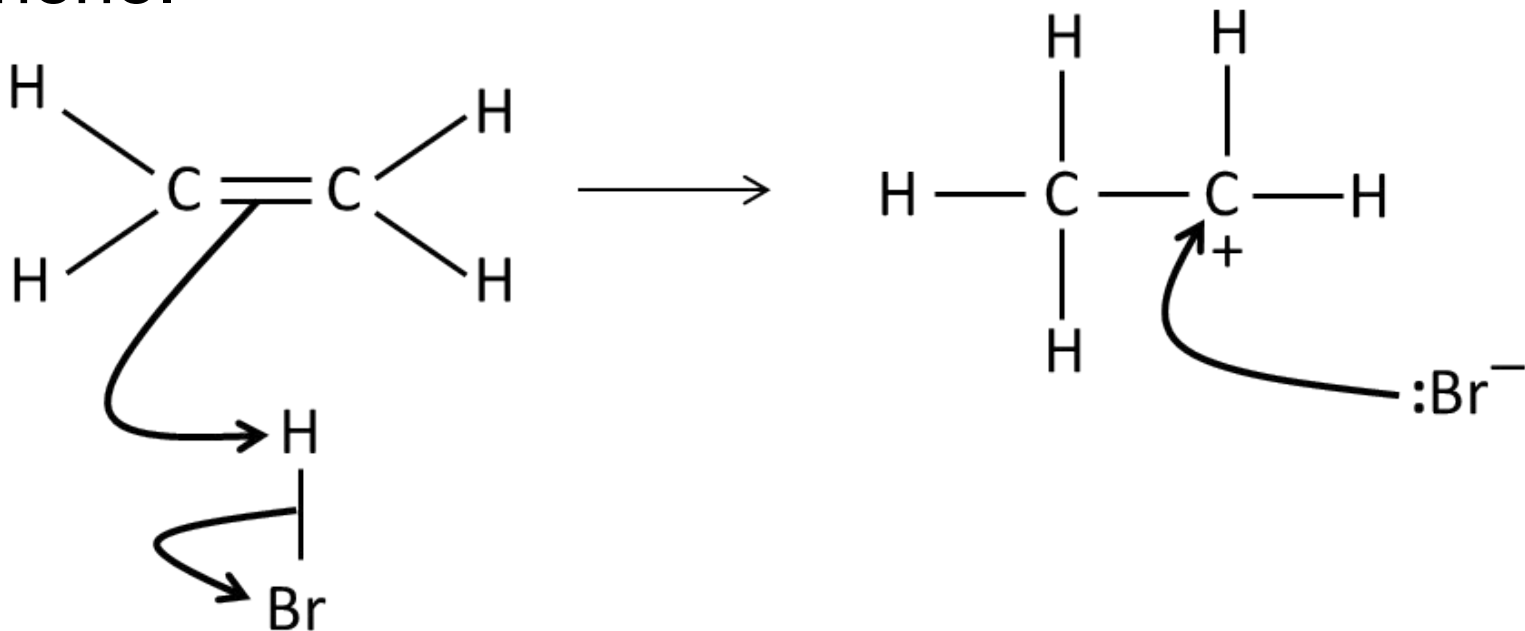


Draw a mechanism for the reaction of HBr and ethene.





Draw a mechanism for the reaction of HBr and ethene.



What conditions are needed for the electrophilic addition of a halogen molecule to an alkene?



What conditions are needed for the electrophilic addition of a halogen molecule to an alkene?

Room temperature and organic solvent



How does a molecule with a non-polar bond react as if it is an electrophile?



How does a molecule with a non-polar bond react as if it is an electrophile?

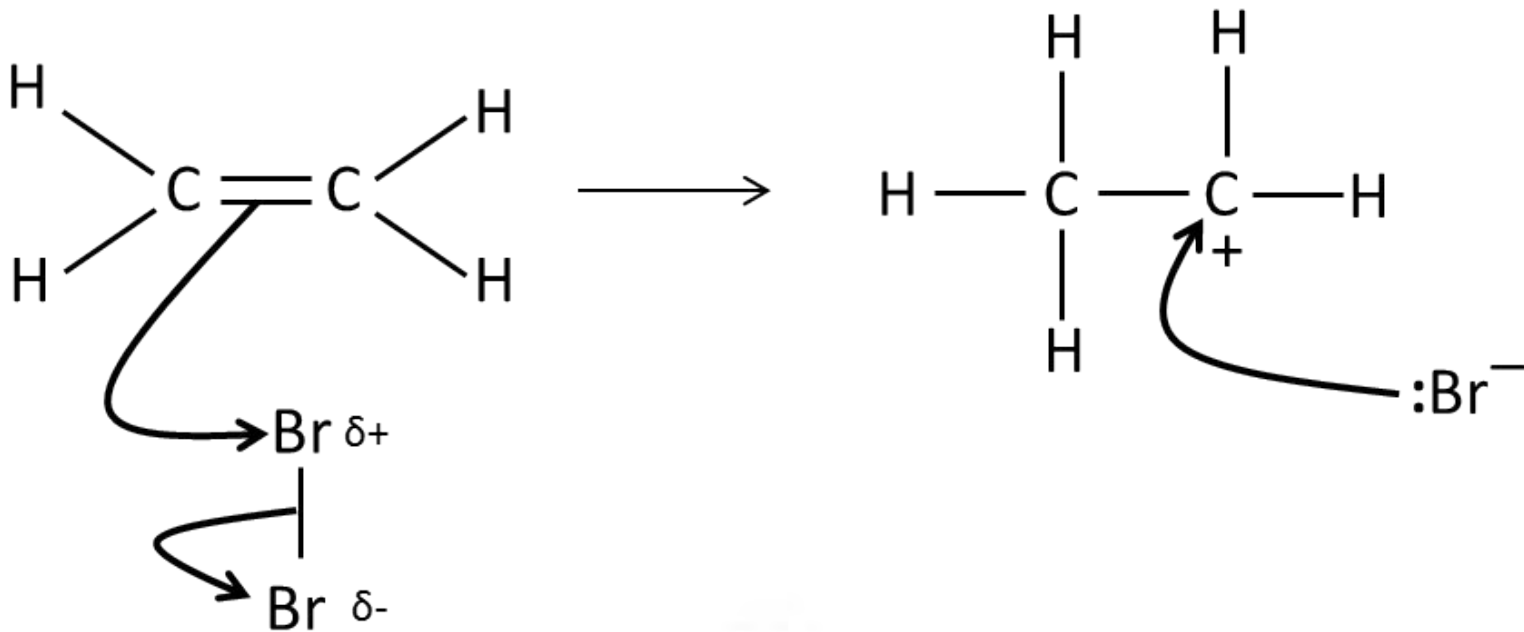
C=C double bond with a high electron density induces a temporary dipole in the halogen molecule →  $\delta^+$  atom attracted to double bond



Draw a mechanism for the  
reaction between bromine  
and ethene



Draw a mechanism for the reaction between bromine and ethene

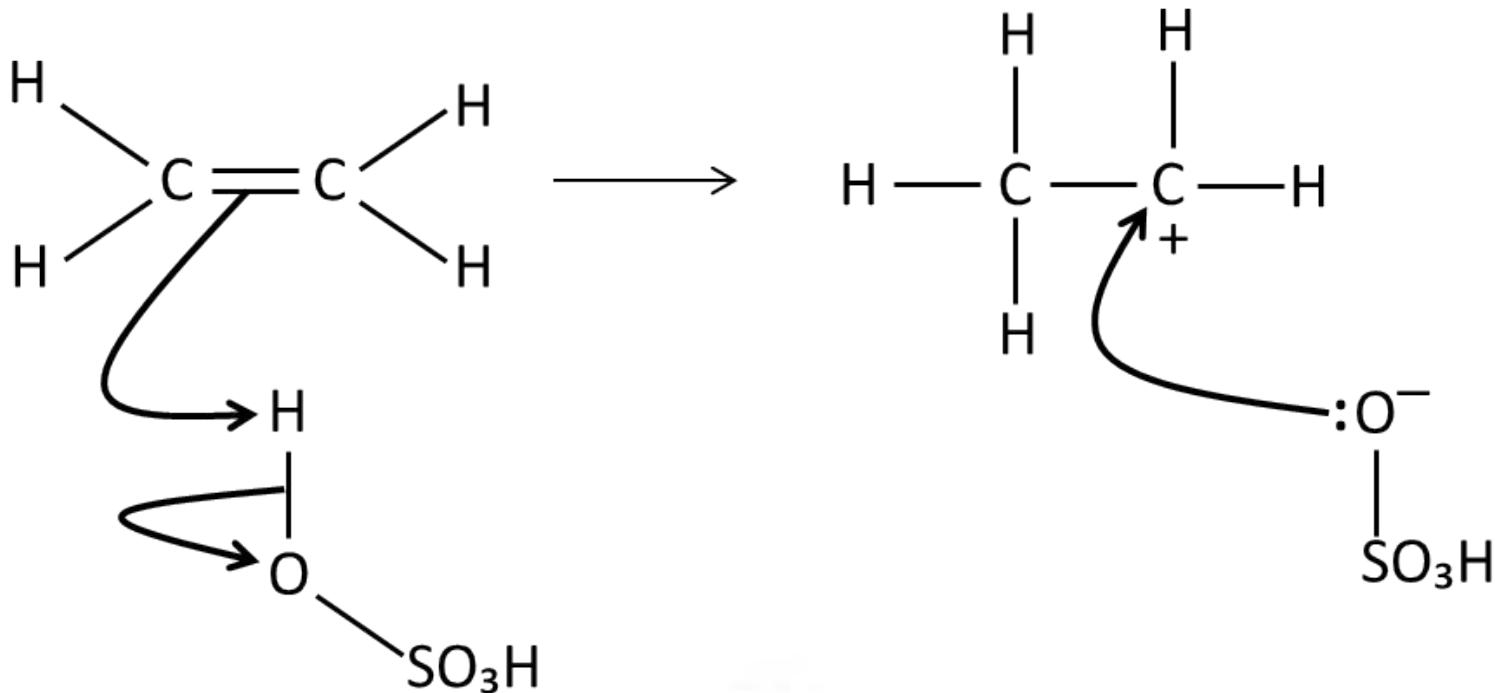


Draw a mechanism for the reaction of sulfuric acid with ethene.





Draw a mechanism for the reaction of sulfuric acid with ethene.



How would you turn the product (from sulfuric acid + ethene) into an alcohol and how does this show that sulfuric acid catalyses the addition of water to an alkene?



How would you turn the product into an alcohol and how does show that sulfuric acid catalyses the addition of water to an alkene?

Add water

$\text{H}_2\text{SO}_4$  reforms, showing it catalyses the hydration of alkenes



# What is an addition polymer?



# What is an addition polymer?

many monomers bonded together via rearrangement of bonds without the loss of any atom or molecule



# What are monomers? What form do they usually take?



What are monomers? What form do they usually take?

Molecules which combine to form a polymer

Usually have a C=C bond which breaks to leave a repeating pattern

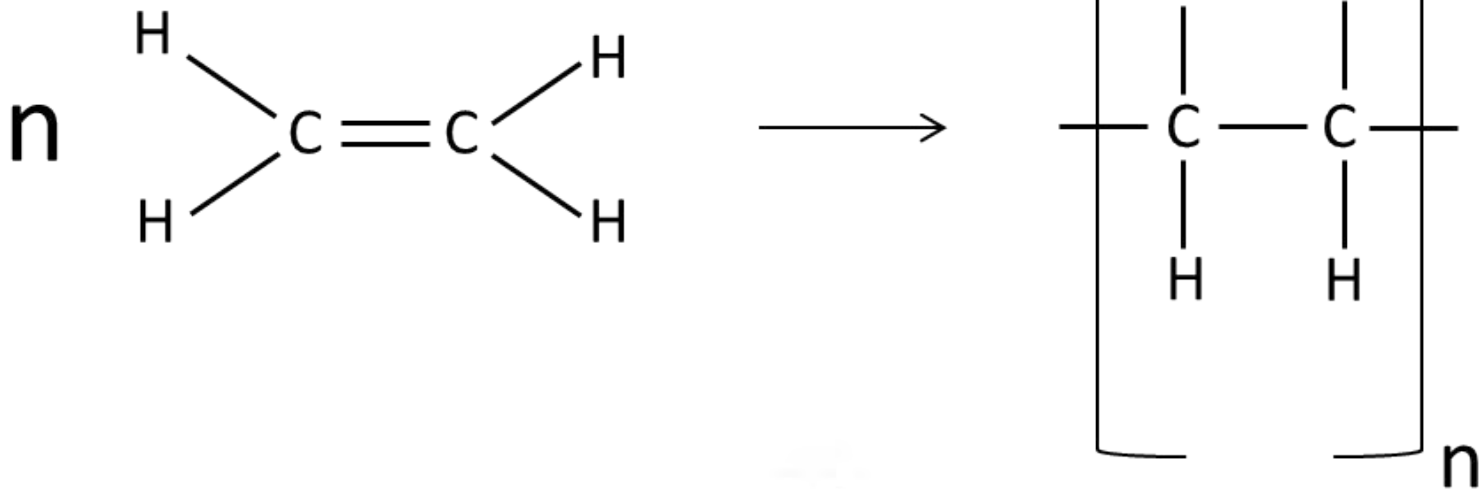


Draw how you would  
represent the polymerisation  
of ethene.





Draw how you would represent the polymerisation of ethene.



Give 3 uses of  
poly(chloroethene) / PVC



Give 3 uses of poly(chloroethene) / PVC

Drainpipes

Vinyl

Aprons



# Give two examples of plasticisers



Give two examples of plasticisers

esters and phthalates



# What are plasticisers?



# What are plasticisers?

Small molecules that get between polymer chains to force them apart and allow them to slide over one another



How do the physical properties of PVC change due to a plasticiser? What applications does this lead to?





**How do the physical properties of PVC change due to a plasticiser? What applications does this lead to?**

PVC with a plasticiser become flexible, used for aprons

Without a plasticiser, PVC is rigid, used for drainpipes



Why do things containing mainly C-C and C-H bonds not decompose easily?



Why do things containing mainly C-C and C-H bonds not decompose easily?

Bonds are non-polar so are not attacked by enzymes



Why is a lack of  
biodegradability in  
compounds with C-C or C-H  
bonds a problem?



Why is a lack of biodegradability in compounds with C-C or C-H bonds a problem?

Disposal is very problematic



# What is mechanical recycling?



# What is mechanical recycling?

Where plastics are separated into different types, washed, ground down, melted and re-moulded



# What is mechanical recycling used for?





What is mechanical recycling used for?

Soft drinks bottles → fleeces



# What is feedstock recycling?



# What is feedstock recycling?

Plastics heated to a temperature which break polymer bonds, leaving original monomers that can be made into new plastics



# What is feedstock recycling used for?



What is feedstock recycling used for?

Making totally new plastics



# What is a problem with recycling?



# What is a problem with recycling?

Each time thermosoftening plastics are melted and remoulded, their properties degrade, so they can only be remoulded a limited number of times

