Organic reactions

Part 1

Juffrou Karen

Organic reactions

- Combustion/ Oxidation
- Esterification
- Addition reactions
- Elimination reactions
- Substitution reactions
- Cracking:
  - Thermal
  - Catalytic

Important

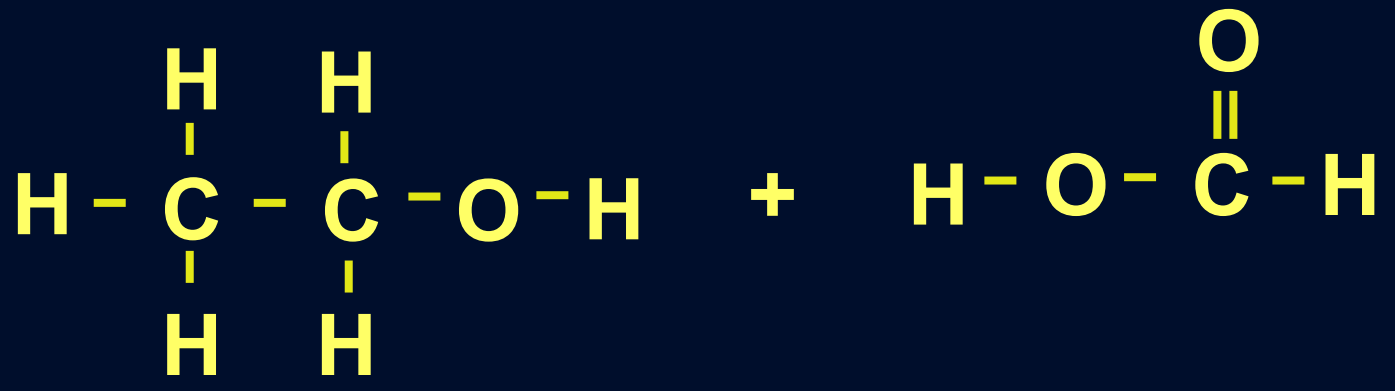
- You need to be able to identify:
  - reactants
  - products
  - reaction conditions
- Structural formulae
- IUPAC - naming

Juffrou Karen

Esterification

Acid-catalyzed condensation

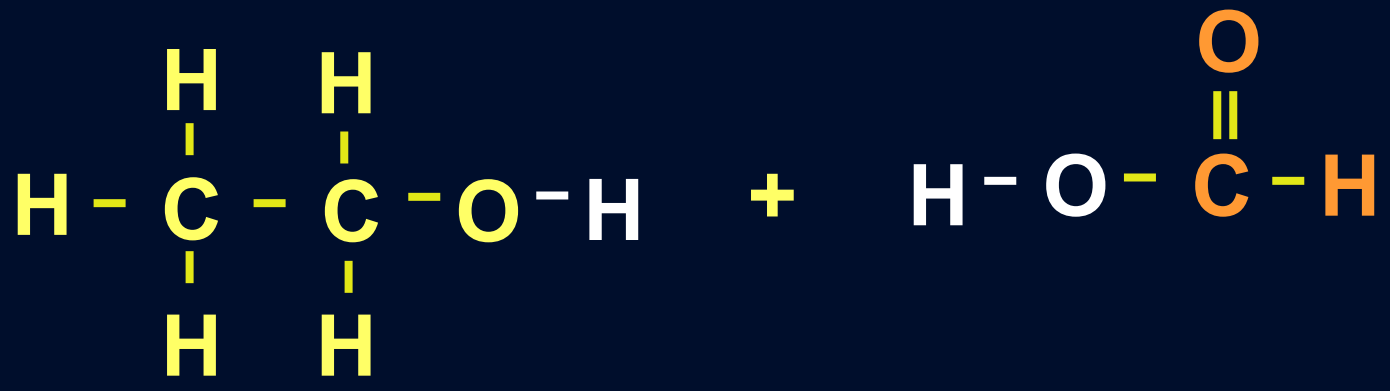
Reactants: Alcohols and carboxylic acids



Ethanol

Methanoic acid

Esterification

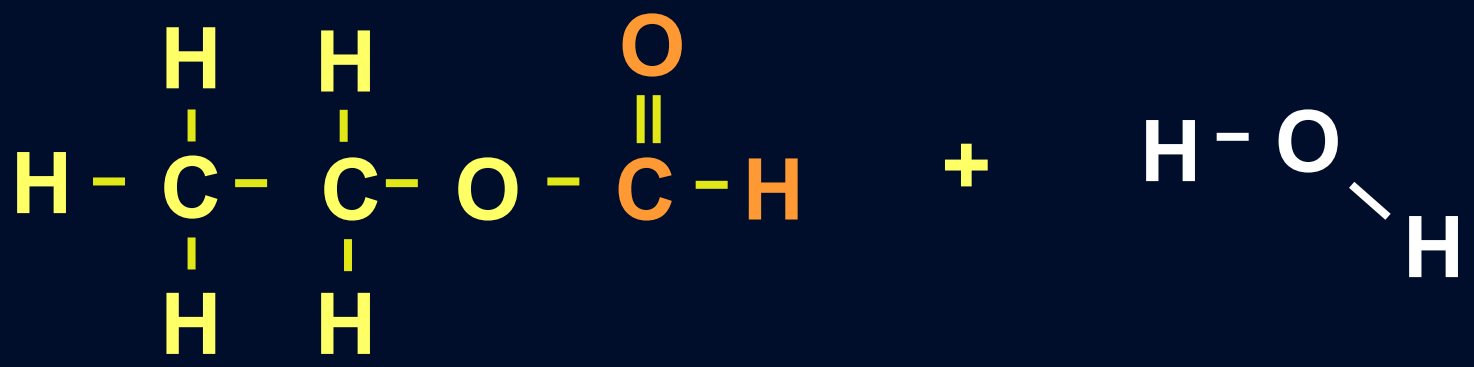


Ethanol

Methanoic acid

Esterification

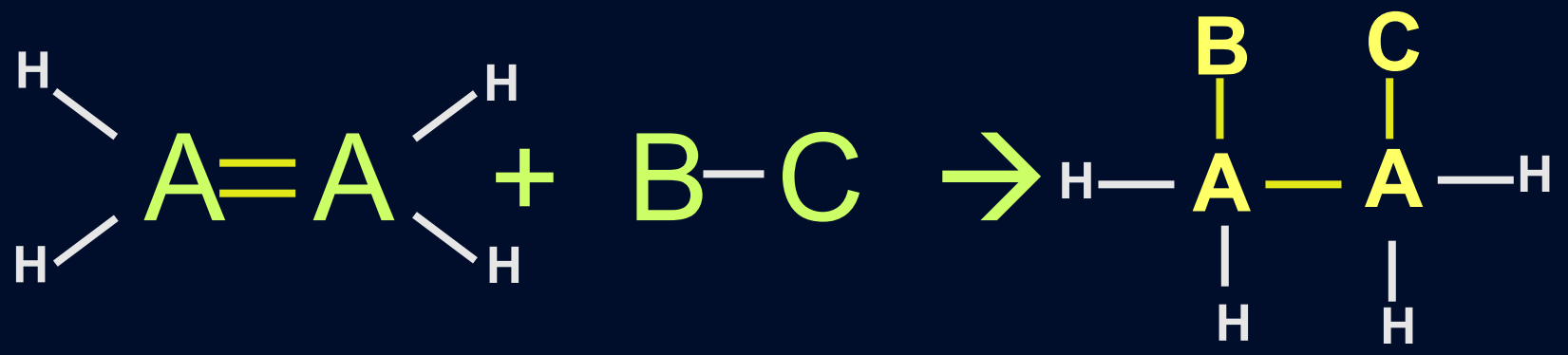
Products: Ester and water



Ethyl methanoate

(Ethanol) (Methanoic acid)

Addition reactions



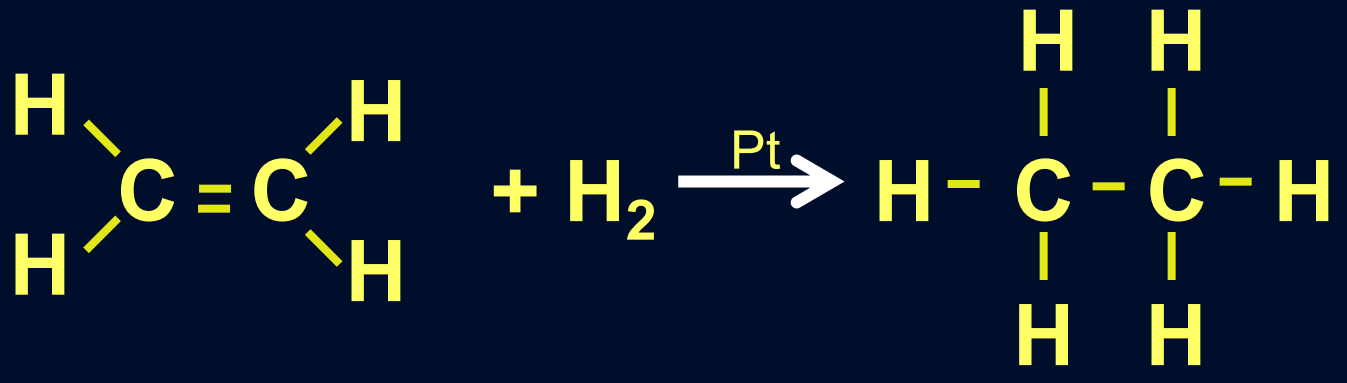
Unsaturated compound → Saturated compound

Addition reaction

(Hydrogenation)

$H_2(g)$ + alkene moves over catalyst.

The process is used to make margarine from plant oils.



ethene *ethane*

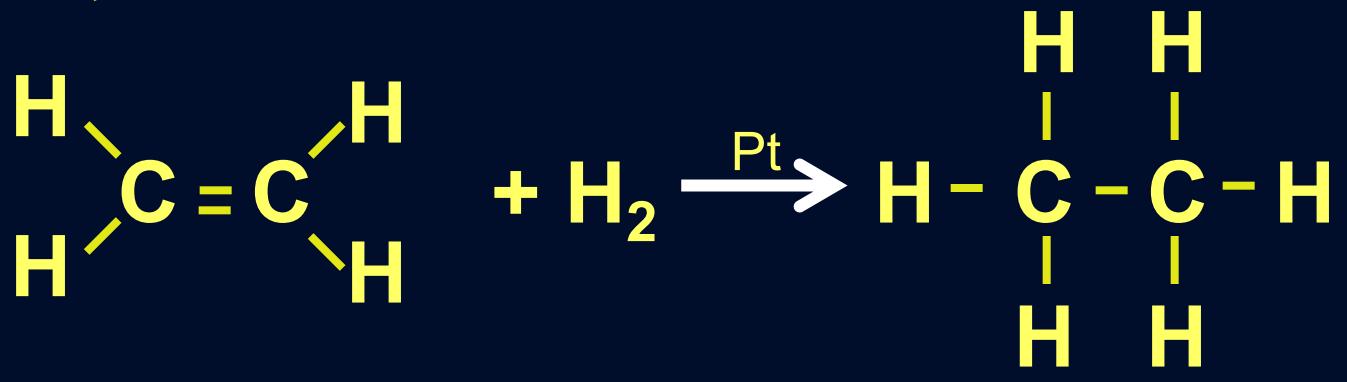
Addition reaction

(Hydrogenation)

Reaction conditions:

Alkene dissolved in non-polar solvent

Catalyst: Pt, Ni, Pd

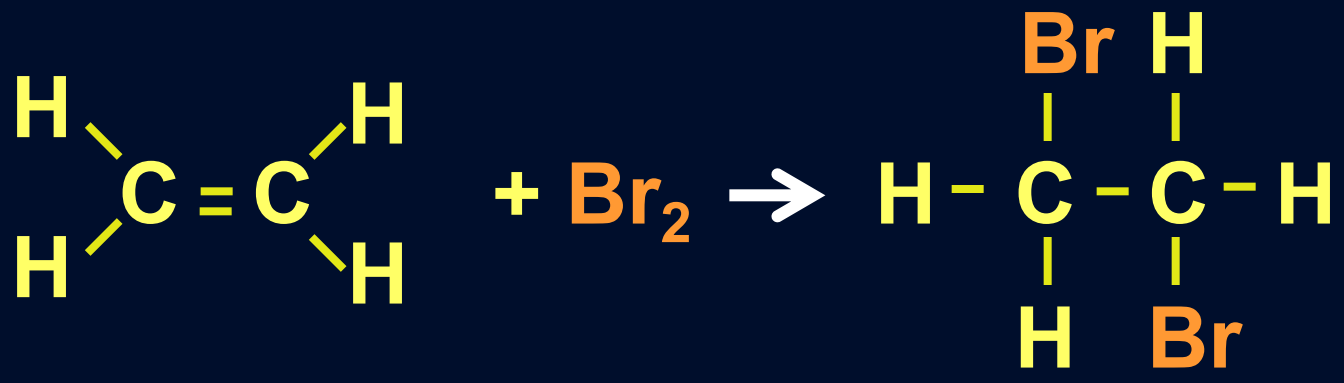


ethene *ethane*

Addition reaction

(Halogenation)

Bubble a halogen through an alkene



ethene

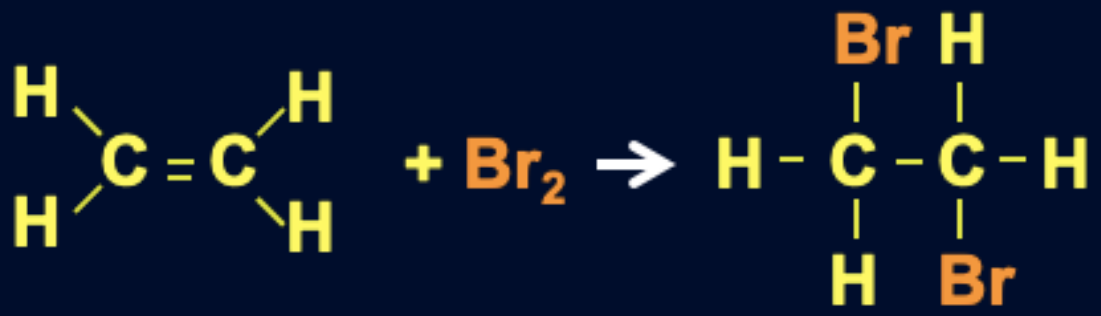
1,2-dibromoethane

Addition reaction

(Halogenation)

Reaction conditions:

Absence of water! NO water!

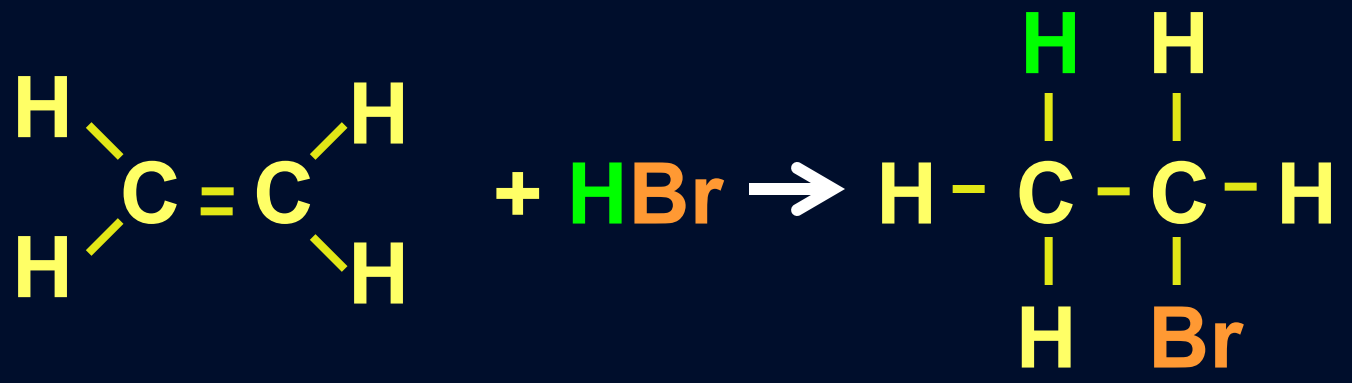


ethene *1,2-dibromoethane*

Addition reaction

(Hydrohalogenation)

Bubble a hydrogen halide through an alkene.



ethene *bromoethane*

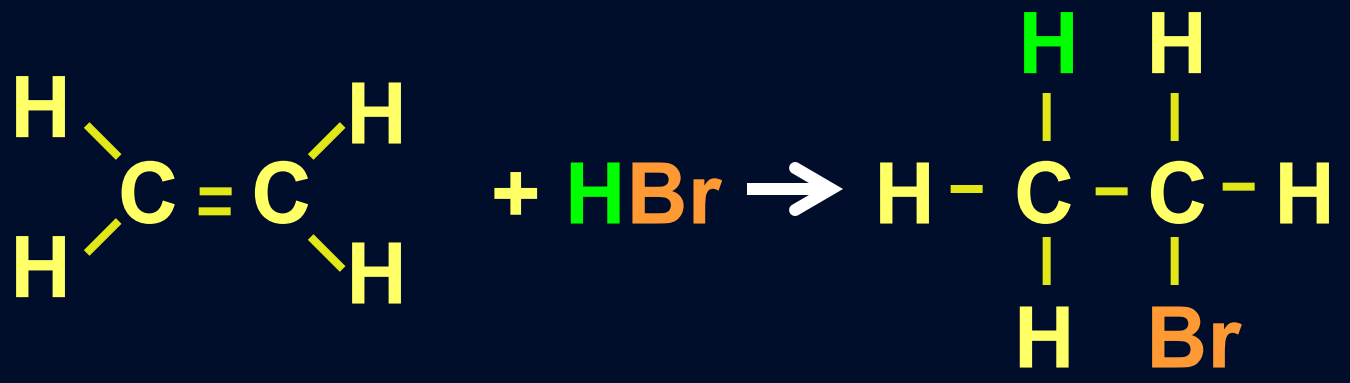
Addition reaction

(Hydrohalogenation)

Markovnikov's rule will apply!

Reaction conditions:

Absence of water! NO water!

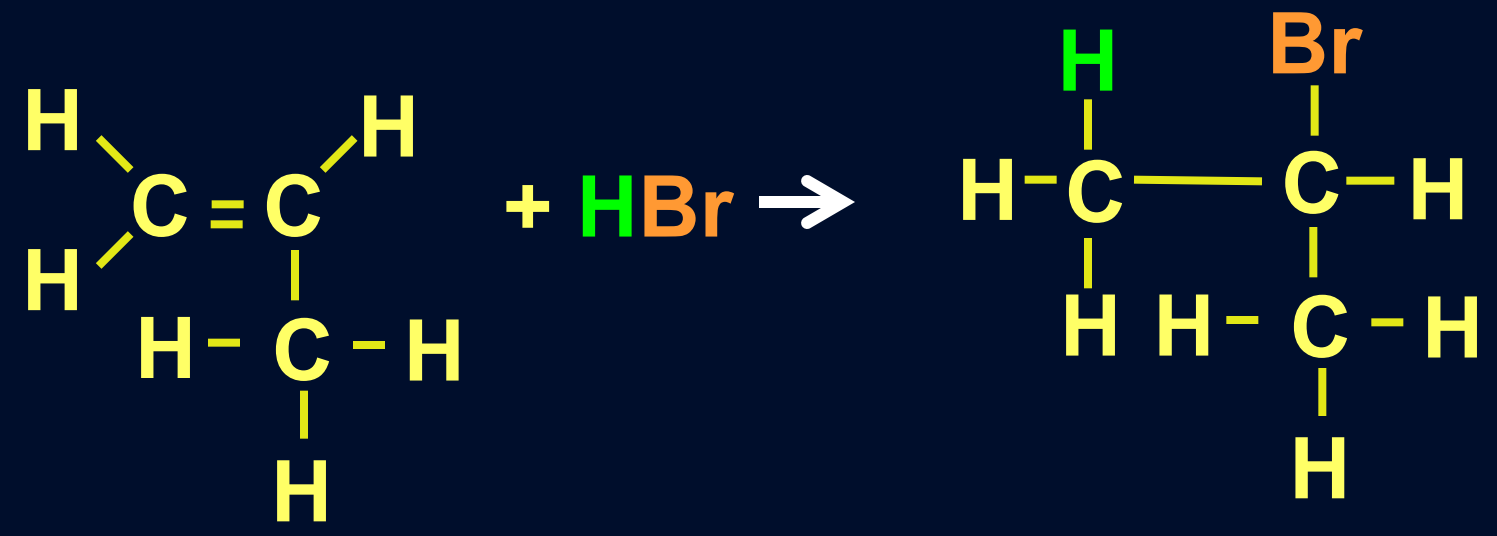


ethene *bromoethane*

Addition reaction

(**Markovnikov's rule**)

The carbon with the most hydrogens will get another hydrogen. (Main product)



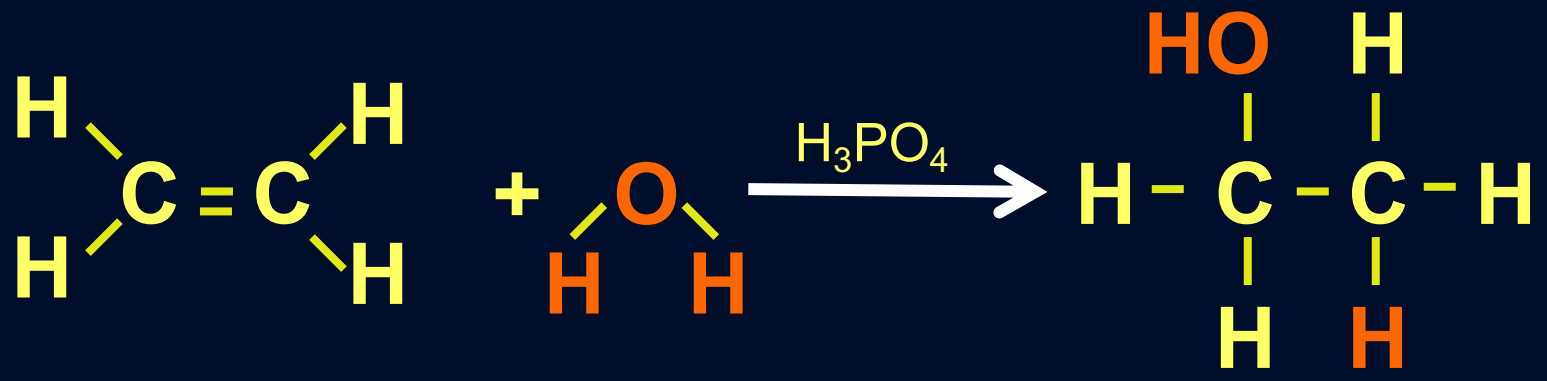
propene *2-bromopropane*

Addition reaction

(Hydration)

Markovnikov's rule will apply!

Industry – preparation of alcohols. H_2PO_4 is used as catalyst



ethene *ethanol*

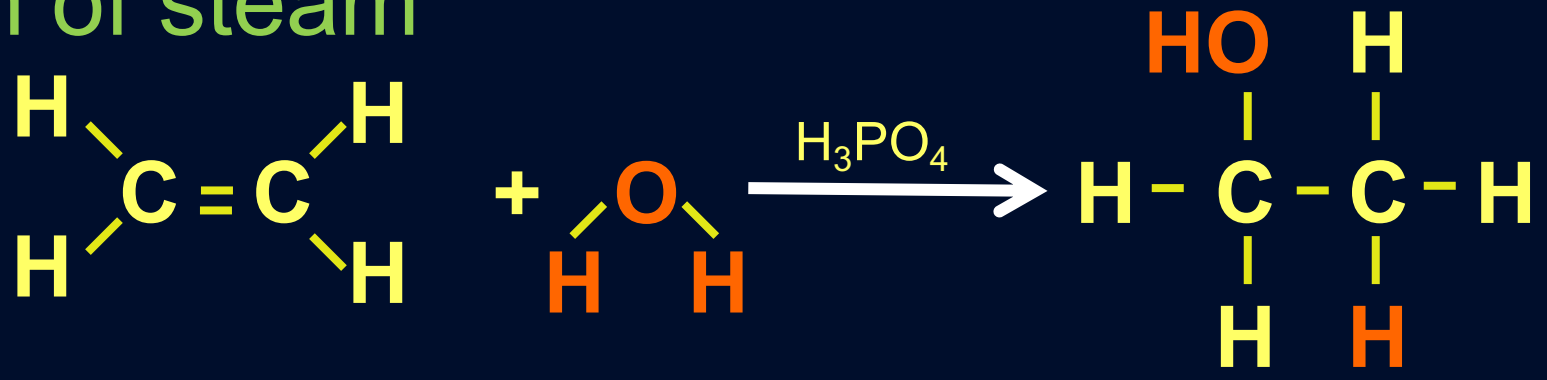
Addition reaction

(Hydration)

Reaction conditions:

Catalyst: Strong, dilute acid

Heat in form of steam

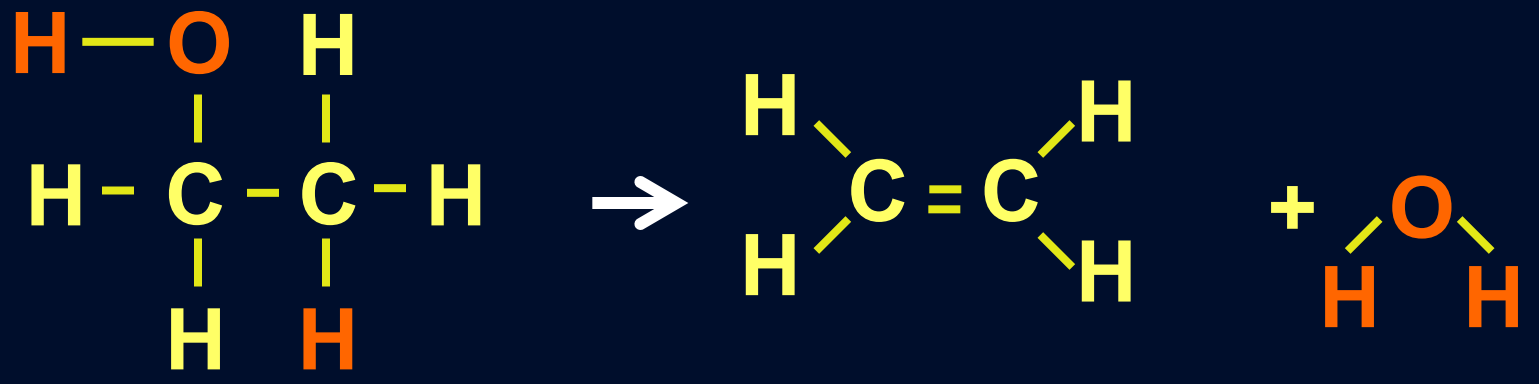


ethene *ethanol*

Elimination reaction

Saturated compound → Unsaturated compound

e.g. Ethanol moved across a hot catalyst



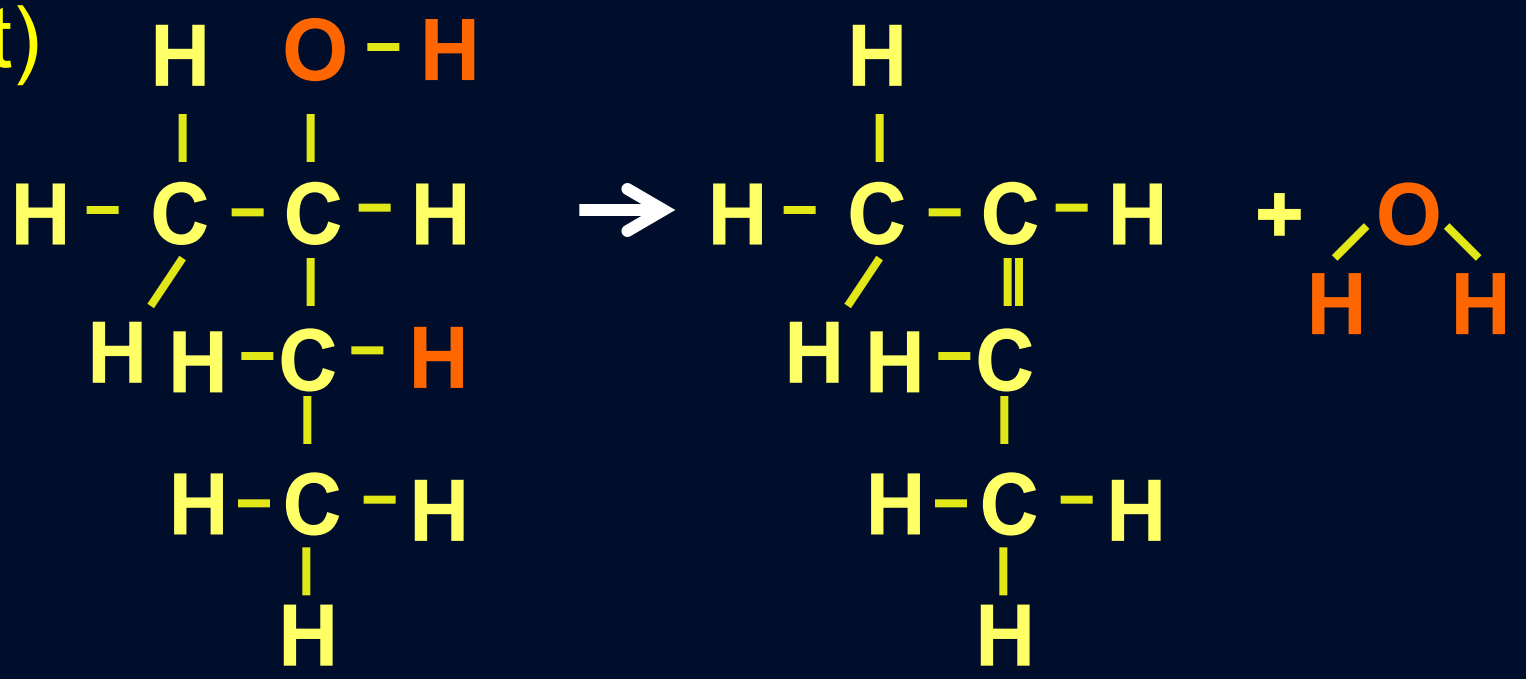
ethanol *ethene*

Elimination reaction

Zaitzev's rule

The carbon next to the hydroxyl with the least amount of hydrogens will lose a hydrogen to form a double bond

(Main product)



Butan-2-ol *But-2-ene*

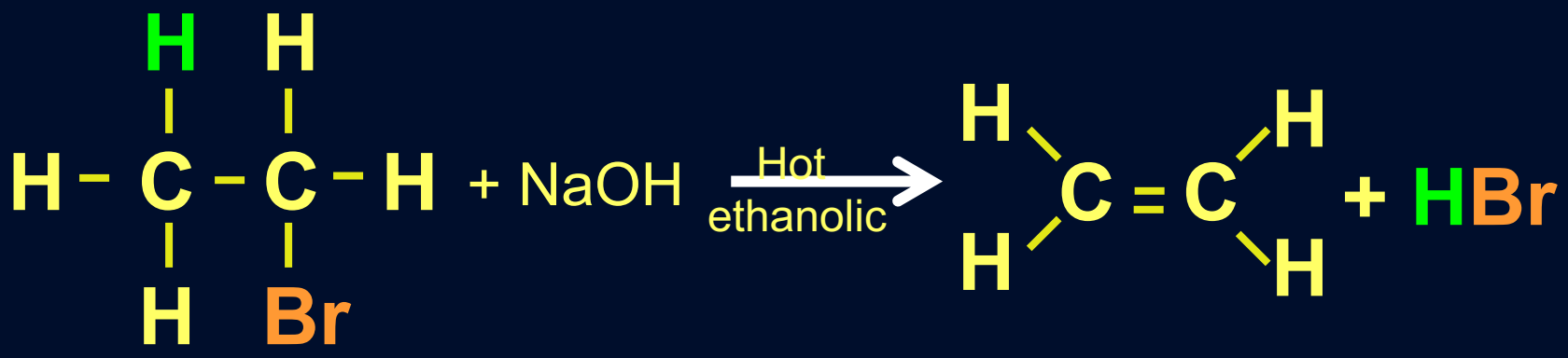
Elimination reaction

(Dehydrohalogenation)

Zaitzev's rule will apply!

Reaction conditions:

Concentrated NaOH or KOH in ethanol as solvent; **strong heat**



bromoethane *ethene*

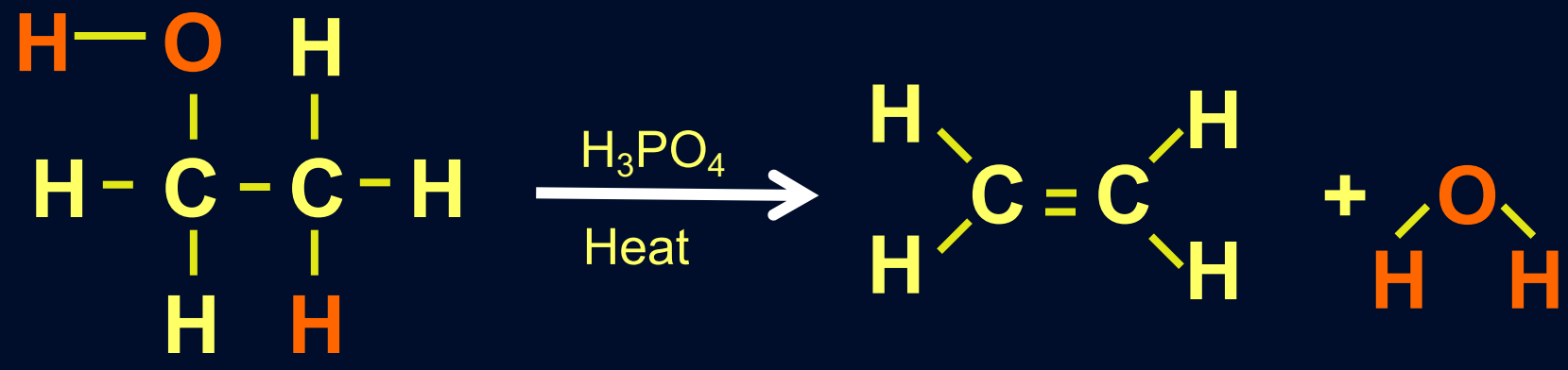
Elimination reaction

(Dehydration)

Zaitzev's rule will apply!

Reaction conditions:

Catalyst: Strong conc acid in excess; heating of alcohol



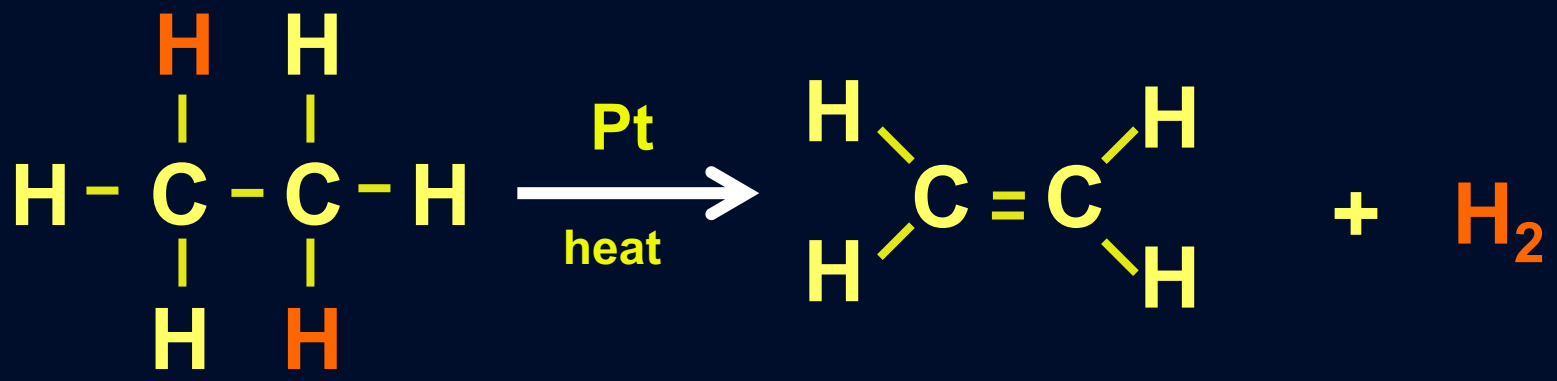
ethanol *ethene*

Elimination reaction
(Cracking)

Thermal cracking

Catalytic cracking

Saturated compound is cracked to produce an unsaturated compound



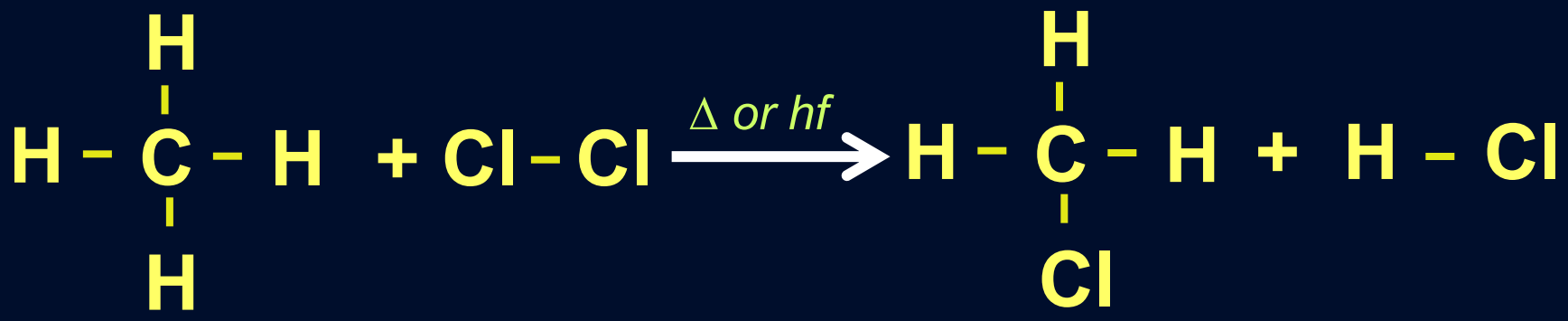
ethane

ethene

Substitution reaction

Halogenation (e.g. Alkanes)

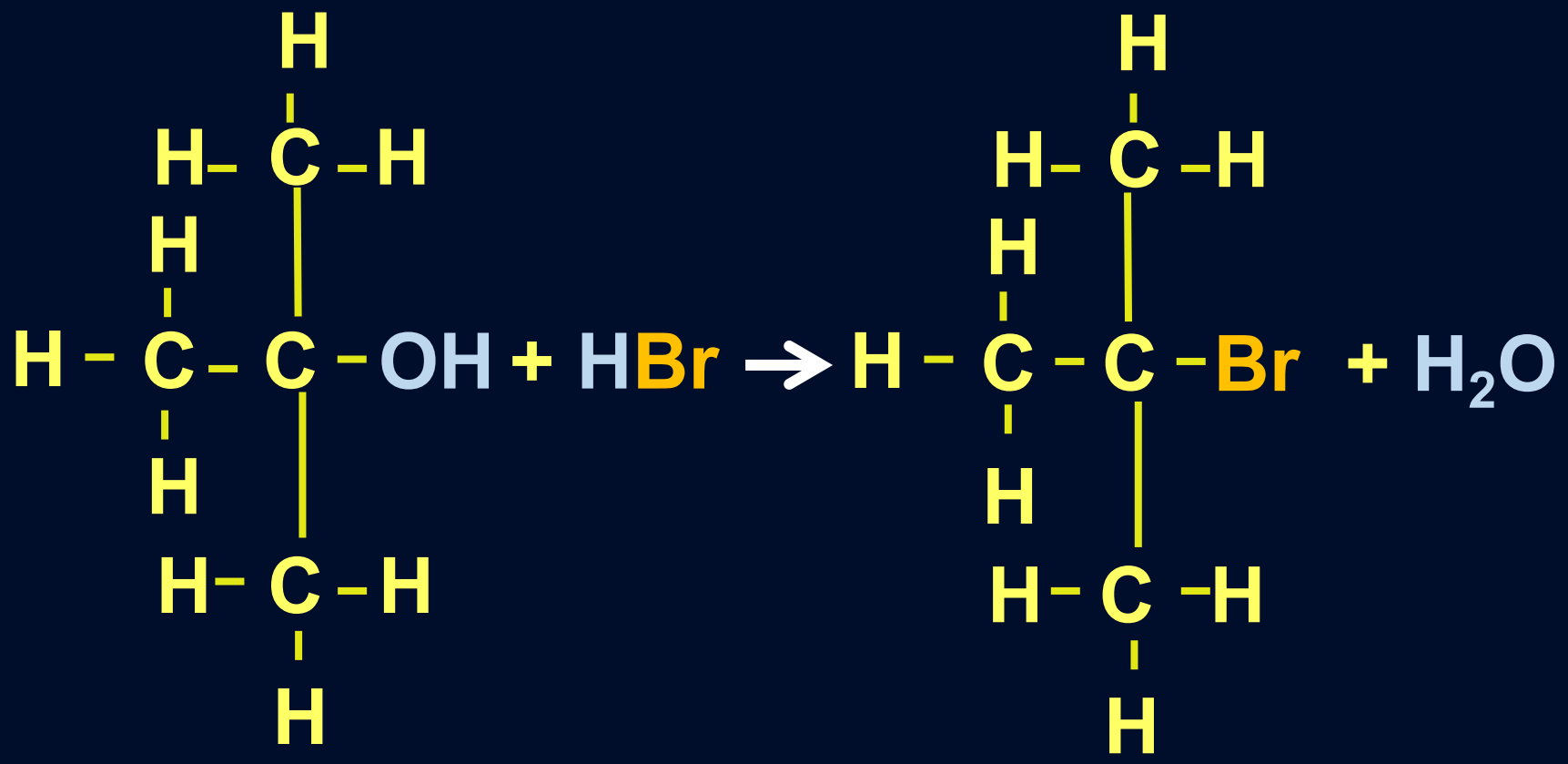
$$A\text{-}B + C \rightarrow A\text{-}C + B$$



Methane *Chlorine* *Chloromethane*

Substitution reaction

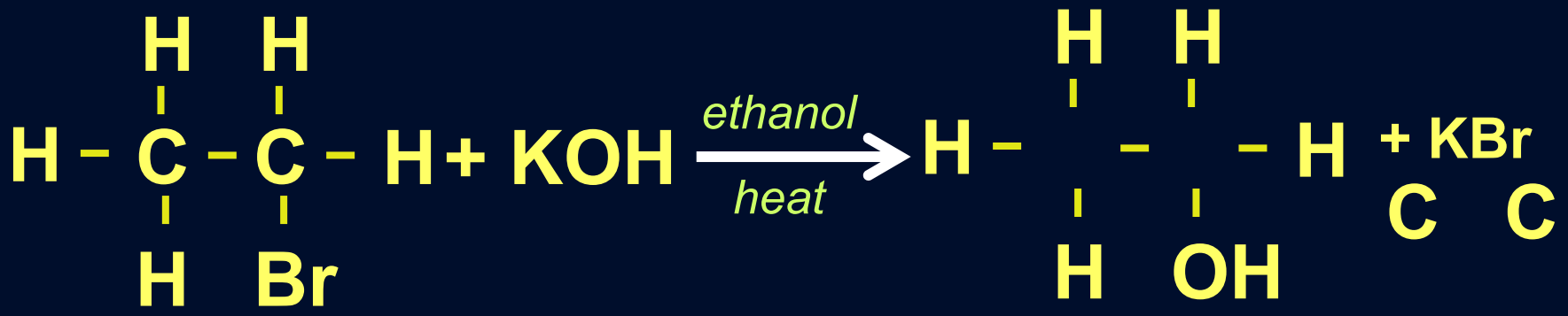
Hydrohalogenation (e.g. Tertiary alcohols)



Tertiary alcohol *Halo-alkane*

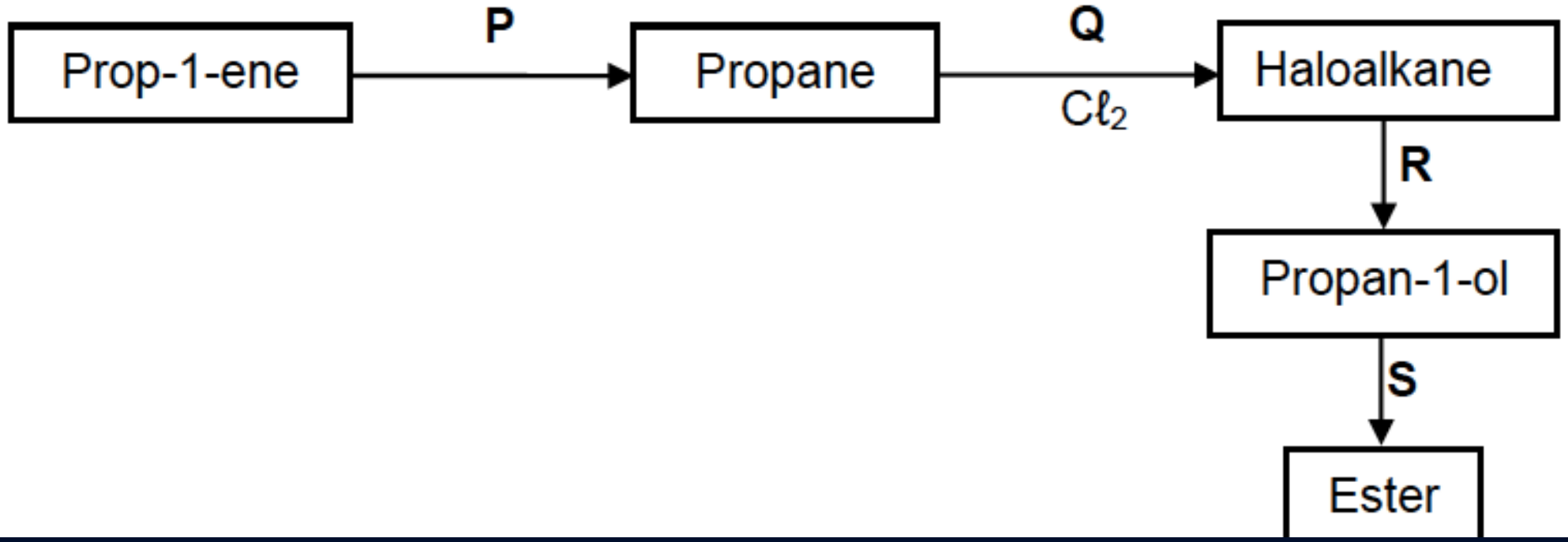
Substitution reaction

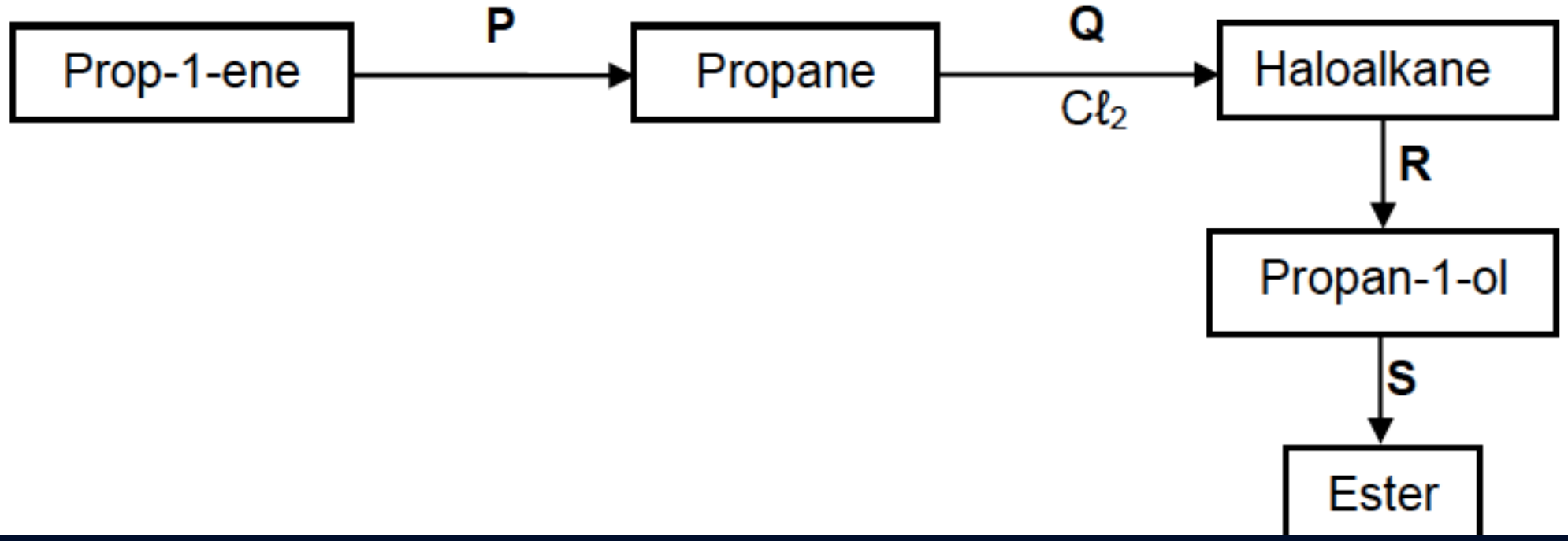
Hydrolysis (e.g. Halo-alkanes)



QUESTION 1

The flow diagram below shows the preparation of an ester using prop-1-ene as a starting reagent. **P**, **Q**, **R** and **S** represent different organic reactions.

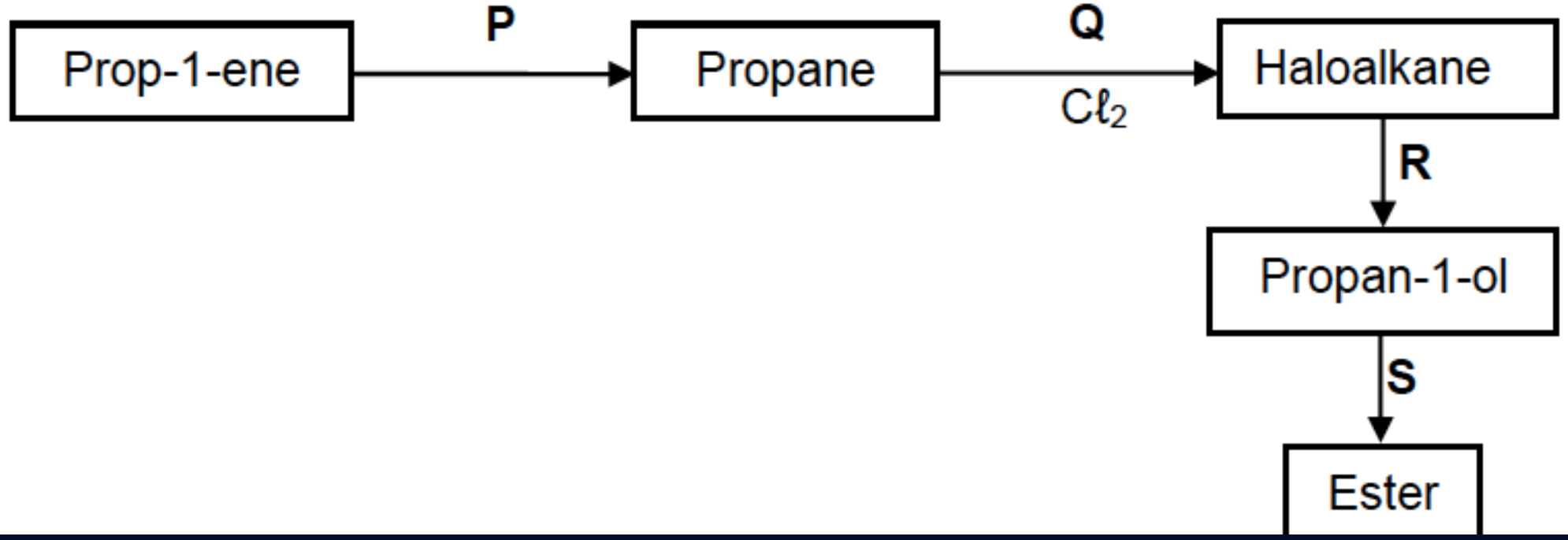




1.1 Write down the type of reaction represented by:

1.1.1 **Q** (1)

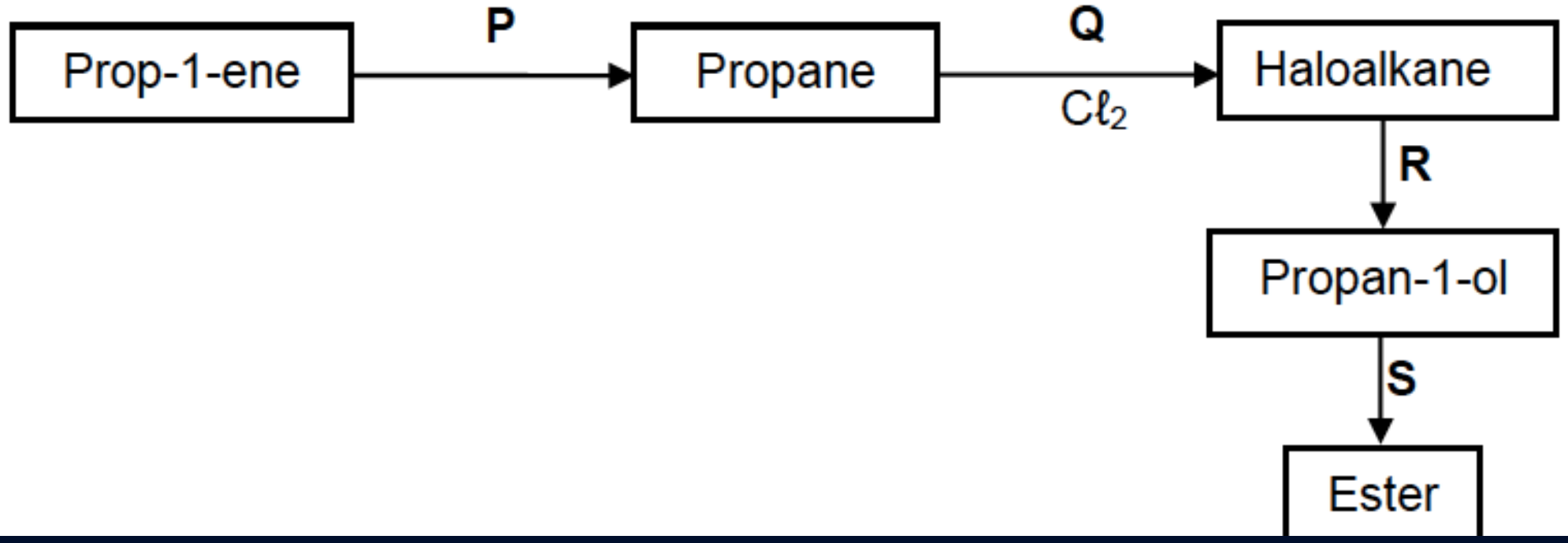
1.1.2 **R** (1)



1.2 For reaction **P** write down the:

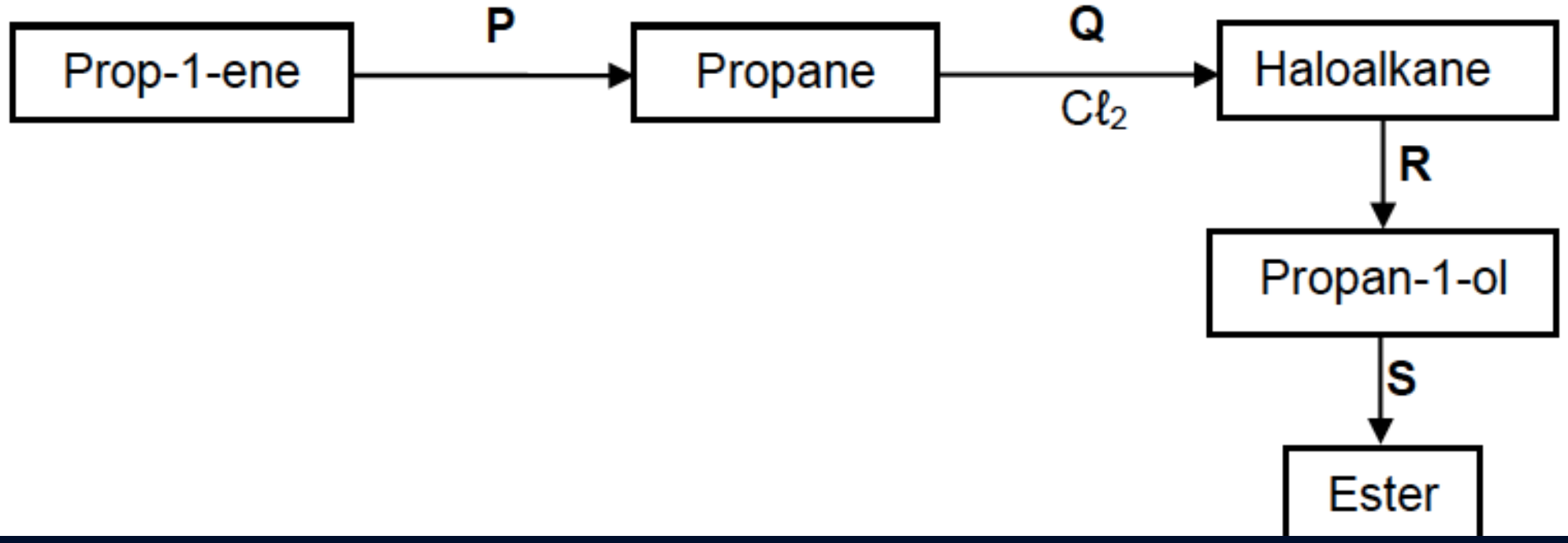
1.2.1 Type of addition reaction (1)

1.2.2 Balanced equation using structural formulae (3)



1.4 In reaction **S** propan-1-ol reacts with ethanoic acid to form the ester. For this reaction write down the:

1.4.1	Name of the reaction that takes place	(1)
1.4.2	FORMULA or NAME of the catalyst needed	(1)
1.4.3	Structural formula of the ester formed	(2)
1.4.4	IUPAC name of the ester formed	(2)



1.5 The propan-1-ol formed in reaction **R** can be converted to prop-1-ene. Write down the FORMULA or NAME of the inorganic reagent needed. (1)