# Introduction to Organic Chemistry Mind Map (A Level)

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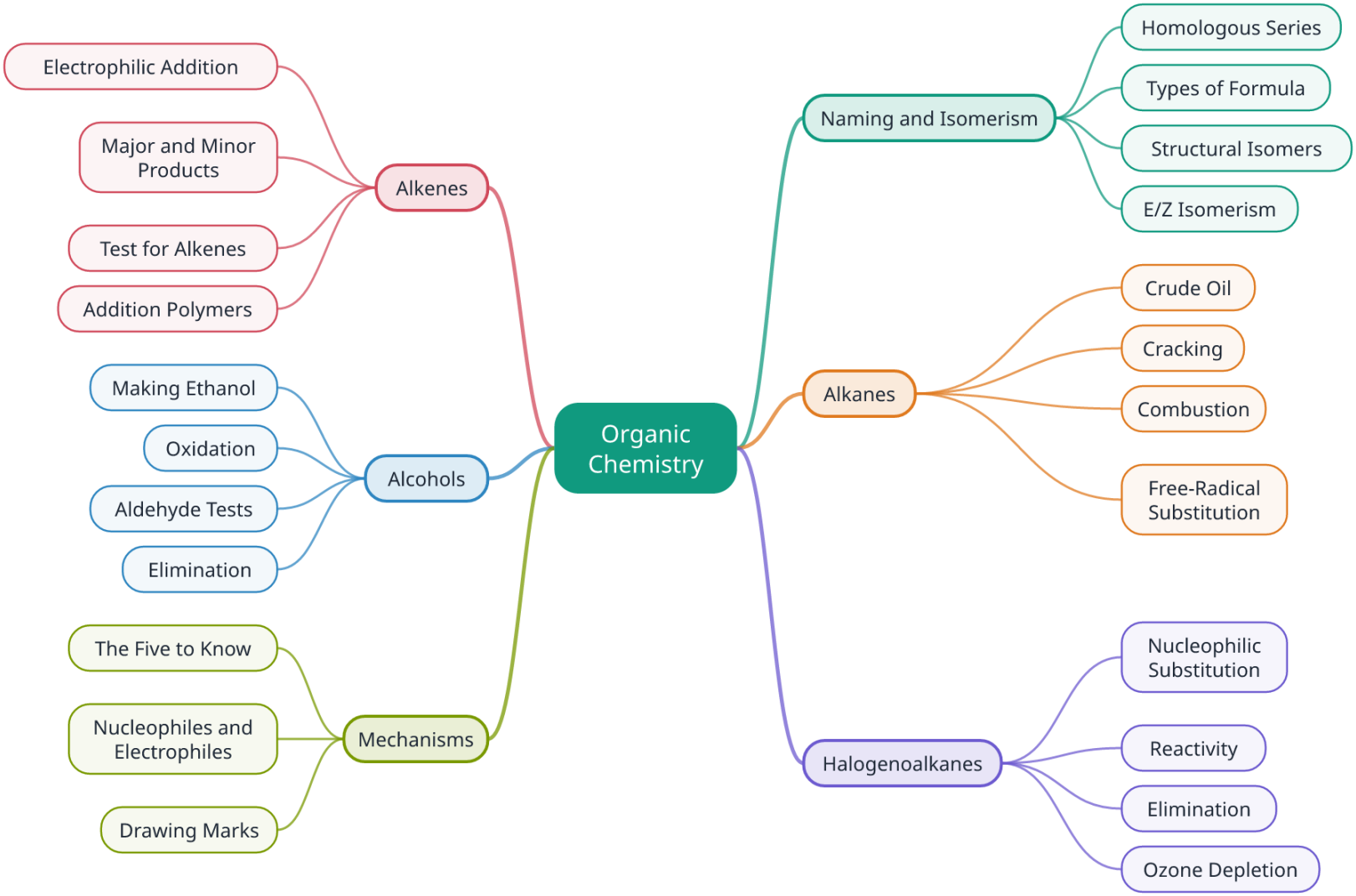


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# Introduction to Organic Chemistry mind map explained

## Naming and Isomerism

The language of organic chemistry.

### Homologous Series

A family of compounds with the same functional group and general formula, where each member differs by CH2.

### Types of Formula

Molecular, empirical, general, structural, displayed and skeletal formulae.

### Structural Isomers

Same molecular formula, different structural formula: chain, position and functional group isomers.

### E/Z Isomerism

A type of stereoisomerism caused by restricted rotation around a C=C double bond. Priorities are set by the Cahn-Ingold-Prelog rules: Z when the higher-priority groups are on the same side, E when opposite.

## Alkanes

Saturated hydrocarbons with the general formula CnH2n+2.

### Crude Oil

Separated into fractions by fractional distillation, based on boiling point.

### Cracking

Breaks long alkanes into shorter, more useful ones and alkenes. Thermal cracking uses high temperature and pressure; catalytic cracking uses a zeolite catalyst and gives branched and aromatic hydrocarbons.

### Combustion

Complete combustion gives carbon dioxide and water. Incomplete combustion also gives carbon monoxide and soot. Pollutants such as nitrogen oxides and sulfur dioxide are reduced by catalytic converters and flue gas desulfurisation.

### Free-Radical Substitution

Alkane + chlorine in UV light. Initiation forms chlorine radicals; propagation steps keep the chain going; termination joins two radicals.

## Halogenoalkanes

Alkanes with one or more halogen atoms. The C-X bond is polar.

### Nucleophilic Substitution

Nucleophiles such as hydroxide ions, cyanide ions and ammonia attack the slightly positive carbon and replace the halogen.

### Reactivity

Set by the C-X bond enthalpy: the C-I bond is the weakest, so iodoalkanes react fastest.

### Elimination

With hydroxide ions in hot ethanol, the hydroxide acts as a base and an alkene forms.

### Ozone Depletion

UV light breaks C-Cl bonds in CFCs, releasing chlorine radicals that catalyse the breakdown of ozone.

## Alkenes

Unsaturated hydrocarbons, CnH2n, with a C=C double bond: an area of high electron density.

### Electrophilic Addition

Electrophiles such as hydrogen bromide, bromine and sulfuric acid add across the double bond, through a

carbocation intermediate.

### Major and Minor Products

With an unsymmetrical alkene, the more stable carbocation (tertiary over secondary over primary) leads to the major product.

### Test for Alkenes

Bromine water turns from orange to colourless.

### Addition Polymers

Alkenes join to form polymers such as poly(ethene) and poly(chloroethene). They are unreactive, which makes disposal a problem.

## Alcohols

Contain the -OH group. Classified as primary, secondary or tertiary by how many carbons are bonded to the carbon carrying the -OH.

### Making Ethanol

Hydration of ethene with steam and a phosphoric acid catalyst (fast, continuous, uses a finite resource), or fermentation of glucose by yeast (renewable, slower, impure).

### Oxidation

With acidified potassium dichromate, which turns from orange to green:

- Primary: aldehyde (distil it off), then carboxylic acid (heat under reflux)
- Secondary: ketone
- Tertiary: not oxidised

### Aldehyde Tests

Aldehydes give a silver mirror with Tollens' reagent and a red precipitate with Fehling's solution; ketones do not.

### Elimination

Heating an alcohol with a concentrated acid catalyst removes water, forming an alkene.

## Mechanisms

Curly arrows show the movement of a pair of electrons, from a bond or lone pair to where it ends up.

### The Five to Know

- Free-radical substitution (alkanes)
- Nucleophilic substitution (halogenoalkanes)
- Elimination (halogenoalkanes, alcohols)
- Electrophilic addition (alkenes)
- Addition polymerisation (alkenes)

### Nucleophiles and Electrophiles

Nucleophiles donate an electron pair and are attracted to positive centres. Electrophiles accept an electron pair and are attracted to areas of high electron density.

### Drawing Marks

Start each arrow at a lone pair or a bond, show the dipole on polar bonds, and draw the intermediate with its charge.

## How to revise with this mind map

1. Draw a reaction map. Put each functional group in a box and draw arrows between them, labelled with the reagent, conditions and mechanism. This is the fastest way to answer synthesis questions.

2. Practise mechanisms by drawing them, not reading them. Marks depend on where every curly arrow starts and ends.

3. Learn reagents and conditions precisely: acidified potassium dichromate, distil or reflux, hot ethanol or water, UV light. Vague conditions lose marks.

4. Know the tests and their results: bromine water, Tollens', Fehling's and acidified dichromate.

5. Make it yours. Build your own organic chemistry map in Mindmapi from your notes, and ask the AI about any reaction you are unsure of. The answer is saved into that branch's notes for next time.