Your notes

GCSE Chemistry: revision notes

Alkenes, alcohols and carboxylic acids

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Alkenes

- Alkenes are hydrocarbons with a carbon–carbon double bond (C=C). Their general formula is C_nH_{2n}.
- The first four are ethene (C_2H_4), propene (C_3H_6), butene (C_4H_8) and pentene (C_5H_{10}).
- Alkenes are **unsaturated**: they have two fewer hydrogen atoms than the alkane with the same number of carbon atoms.
- Alkenes burn with a smoky flame because of incomplete combustion.

Addition reactions of alkenes

- Alkenes react by adding atoms across the double bond, which becomes a single bond.
- With hydrogen (using a nickel catalyst): ethene + hydrogen → ethane.
- With water as steam (using a catalyst): ethene + steam → ethanol.
- With halogens: ethene + bromine → dibromoethane. This is why bromine water is decolourised.

Alcohols

- **Alcohols** contain the **functional group** –OH. The first four are methanol (CH_3OH), ethanol (C_2H_5OH), propanol and butanol.
- They react with sodium to produce hydrogen, burn in air, and dissolve in water to form a neutral solution.
- They can be oxidised to form **carboxylic acids**.
- **Alcohols** are used as fuels and solvents. Ethanol is the **alcohol** in alcoholic drinks.

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- Ethanol can be made by fermenting sugar solutions with yeast, in warm conditions without oxygen.

Carboxylic acids and esters

- **Carboxylic acids** contain the **functional group** –COOH. The first four are methanoic, ethanoic (CH_3COOH), propanoic and butanoic acid.
- They dissolve in water to form acidic solutions, and react with carbonates to produce carbon dioxide.
- They react with **alcohols**, with an acid catalyst, to make **esters**: ethanoic acid + ethanol → ethyl ethanoate + water.
- **Esters** have fruity smells and are used in perfumes and flavourings.
- (Higher) **Carboxylic acids** are weak acids because they only partially ionise in water.

Key terms

Unsaturated	Containing a carbon–carbon double bond.
Functional group	A group of atoms that decides how a compound reacts.
Addition reaction	A reaction in which atoms add across a C=C double bond.
Hydrogenation	Adding hydrogen to an alkene, using a nickel catalyst.
Alcohol	An organic compound containing the –OH functional group.
Carboxylic acid	An organic compound containing the –COOH functional group.
Ester	A compound formed when a carboxylic acid reacts with an alcohol.
Fermentation	Using yeast to convert sugar into ethanol and carbon dioxide.
Homologous series	A family of compounds with the same general formula and similar reactions.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is the general formula of the alkenes?
2. Why are alkenes described as unsaturated?
3. What forms when ethene reacts with hydrogen?
4. What forms when ethene reacts with steam?
5. What is the functional group of the alcohols?
6. What gas forms when sodium reacts with ethanol?
7. What is the functional group of carboxylic acids?

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8. What gas forms when a carboxylic acid reacts with a carbonate?

Answers

1. C_nH_{2n}
2. They contain a C=C double bond
3. Ethane
4. Ethanol
5. –OH
6. Hydrogen
7. –COOH
8. Carbon dioxide

What to do next

Practise 12 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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