

Name: _____

Date: _____

AQA A-LEVEL CHEMISTRY

Chemical Formulae: Representing Organic Compounds

Learn Pack

Guided notes, worked examples and practice questions to be completed alongside the lesson.



What is Organic Chemistry?

The term organic originally referred to _____ things.

Today, organic chemistry is defined as the study of _____ compounds.

Lesson Objectives:

- Why organic chemists use different ways of representing compounds.
- The difference between molecular, empirical and general formulae.
- How to construct and interpret structural, displayed and skeletal

Scientists once believed that organic compounds could only be produced by living organisms. Today, we know that this isn't true and carbon containing compounds are synthesised in laboratories and factories, which is why organic chemistry includes the following:

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-
-
-

Why is carbon so special?

Carbon has _____ electrons in its outermost shell. This allows it to form _____ covalent bonds meaning it can connect to multiple atoms at the same time, creating a huge variety of structures. Carbon also forms strong covalent bonds with other _____ atoms, as a result of this carbon can have the ability to form _____ chains, _____ chains and _____ structures. Carbon atoms can also form single, double and even triple bonds with both itself and other atoms.

The Representation Problem.

So, if carbon can form millions of different compounds, chemists need a reliable way of communicating exactly which compound they're talking about.

Different chemical formulae are needed because:

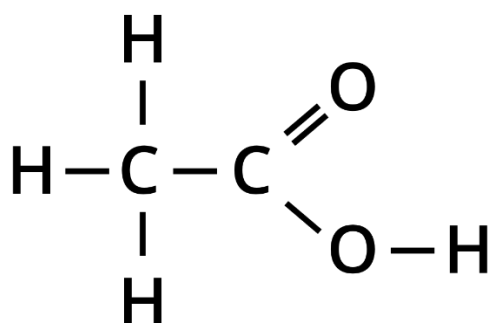
Molecular Formulae

Definition:

A molecular formula gives _____

Worked Example:

Determine the molecular formula of ethanoic acid:



Element	Number of Atoms
Carbon	
Hydrogen	
Oxygen	

Molecular Formula = _____

Ethanol and Dimethyl ether:

Both compounds have the same molecular formula: _____

Why is this a limitation of molecular formulae?

Summary:

Strengths of molecular formulae:

Limitations of molecular formulae:

Empirical Formulae

Definition:

An empirical formula gives _____

Worked Example:

Complete the table:

Molecular Formula	Empirical Formula
C_2H_6	
H_2O_2	
$C_2H_4O_2$	
$C_6H_{12}O_6$	

Summary:

Strengths of empirical formulae:

Limitations of empirical formulae:

General Formulae

Definition:

A general formula is _____

Worked Example:

Complete the table below and answer the questions that follow:

Alkane	Molecular Formula
Methane	
Ethane	
Propane	
Butane	

What pattern can you identify?

General Formula: _____

What does 'n' represent?

Summary:

Strengths of general formulae:

Limitations of general formulae:

Structural Formulae**Definition:**

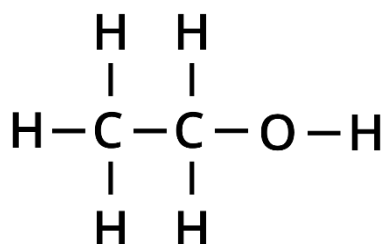
A structural formula shows _____

Structural formulae can distinguish between compounds that have the same molecular formula but different structures, such as ethanol and di-methyl ether. Structural formulae are the standard representation used throughout most of organic chemistry and should always be used when writing symbol equations for organic reactions.

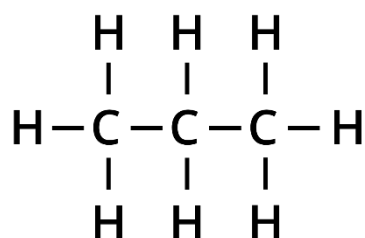
Worked Example:

Write the structural formula for each of the compounds below:

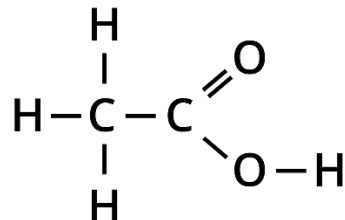
Ethanol:



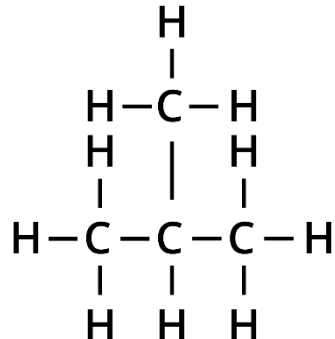
Propane:



Ethanoic Acid:



2-methyl propane:



What do brackets represent in structural formulae?

Summary:

Strengths of structural formulae:

Limitations of structural formulae:

Displayed Formulae

Definition:

A displayed formula is _____

Worked Example:

Draw the displayed formula for each of the compounds below:

Ethane (CH_3CH_3):

Ethanol ($\text{CH}_3\text{CH}_2\text{OH}$):

Summary:

Strengths of displayed formulae:

Limitations of displayed formulae:

Skeletal Formulae

Definition:

A skeletal formula is _____

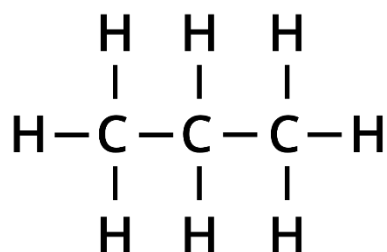
Rules of Skeletal Formulae:

1. Carbon atoms are not shown explicitly
2. Hydrogen atoms attached to carbon atoms are not shown.
3. Any atoms that are not part of the main hydrocarbon chain still need to be shown with the bonds connecting them to the chain.

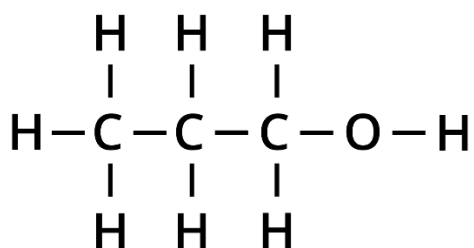
Worked Example:

Draw the skeletal formula for each of the compounds below:

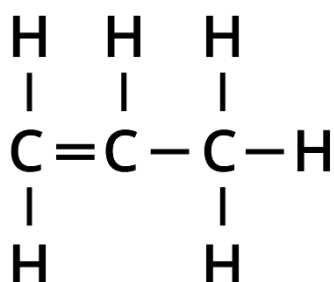
Propane:



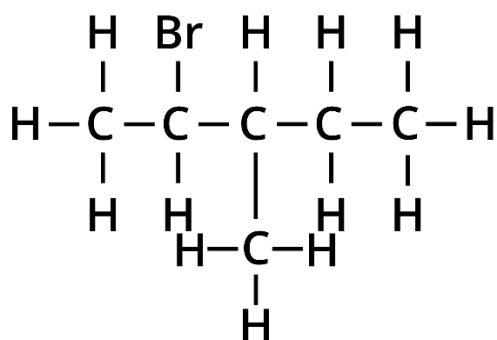
Propan-1-ol:



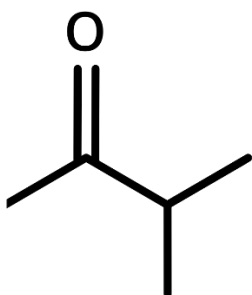
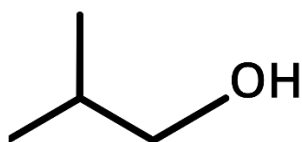
Propene:



2-bromo-3-methyl pentane:



Draw the displayed formula for each of the compounds below:



Summary:

Strengths of skeletal formulae:

Limitations of skeletal formulae:

Practise Questions – Fact Recall

1. What is a molecular formula?

2. How do you work out the empirical formula of a compound from the molecular formula?

3. What is a displayed formula?

Practise Questions – Application

1. Write down the empirical formula of the following compounds:

a) C_3H_6 _____

b) $C_{10}H_{12}Br_2$ _____

c) $C_9H_{17}Cl_3$ _____

2. Write or draw the following chemical formulae for butane, an alkane with 4 carbon atoms:

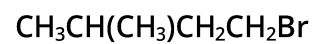
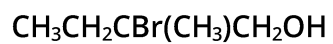
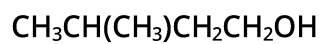
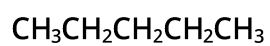
a) Molecular formula

b) Structural formula

c) Displayed formula

d) Skeletal formula

3. Draw skeletal formulae for the following compounds:



4. Convert these skeletal formulae into structural formulae:

