



Types of Chemical Formula

Topic Summary

Chemical formulae are like the language of chemistry. They help scientists explain what substances are made of and how atoms are connected. There are different types of formulae, and each one is useful in different situations.

1. Empirical Formula

- Shows the simplest ratio of elements in a compound.
- Example: Calcium chloride = CaCl_2 (2 chlorine for every calcium).
- Used mainly for ionic compounds.
- Doesn't show the actual number of atoms, just the basic ratio.

2. Molecular Formula

- Shows the actual number of atoms in a molecule.
- Example: Glucose = $\text{C}_6\text{H}_{12}\text{O}_6$
- Useful for covalent compounds (molecules).
- Helps balance chemical reactions.

Important: You can't use a molecular formula for something that isn't a molecule

(like a crystal of salt)!

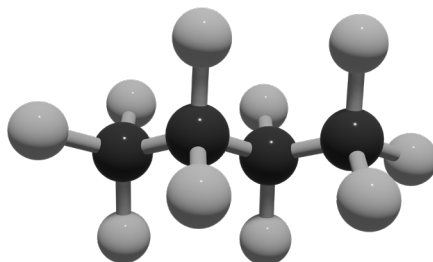
3. Structural Formula - several different types

- Shows how atoms are joined together.
- Condensed Structural Formula can be written on a single line
Example: $\text{CH}_3\text{CH}_2\text{OH}$ for ethanol.
- Displayed Formula: Every atom and bond is shown clearly.
- Skeletal Formula: Simplified and easy to draw for more complex molecules



Quick Checks to Build Recall

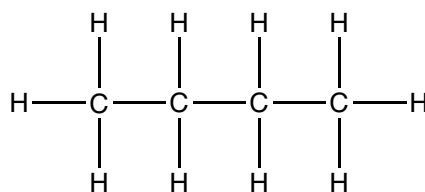
Here is a 3d render of a molecule of butane



Four versions of its chemical formula are given below. Identify which one shows...

- a) the empirical formula
- b) the molecular formula
- c) the displayed formula

What type of formula is shown in the fourth version?



...Molecular...

Condensed Structural..

..Displayed....

...Empirical....



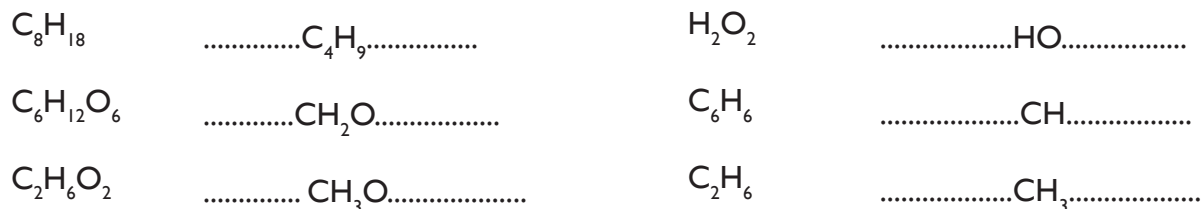


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More examples

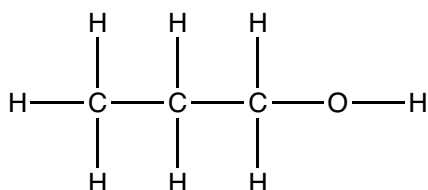
Write the empirical formula for each of these substances



Explain why sodium oxide (Na_2O) does not have a molecular formula.

.....It is an ionic compound.....

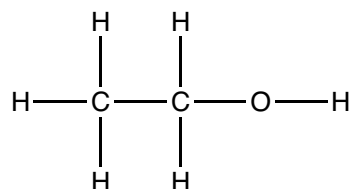
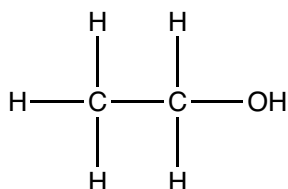
Write out the molecular formula of this organic molecule



..... C_3H_8O [not C_3H_7OH].....

Advanced Question :What is its IUPAC name? ...Propanol (or propan- 1 -ol).....

Another student wrote this as the displayed formula of ethanol (CH_3CH_2OH) and is surprised that they had it marked wrong. Correct their answer for them and explain why they lost the mark



.....The displayed formula shows every bond and the first student missed out the bond between the oxygen and the hydrogen atom.....



Do this later...

Give your brain a break and come back to these questions later. Cover the rest of the sheet while you have a go. By doing this 24-48 hours after watching the video you will boost your chances of remembering the key points in an exam. If you struggle with these questions, re-watch the video and then try again.

Which type of formula shows only the simplest ratio of atoms in a compound? Empirical

Which type of structural formula shows every atom in a molecule and identifies every covalent bond with a straight line? Displayed Formula

Draw out the displayed formula for butane ($CH_3CH_2CH_2CH_3$)

