

MINISTRY OF EDUCATION
SECONDARY ENGAGEMENT PROGRAMME
GRADE 10
CHEMISTRY

WEEK 3

LESSON 2

Topic: Organic Chemistry

Sub-topic: Naming Branched Chain Alkanes

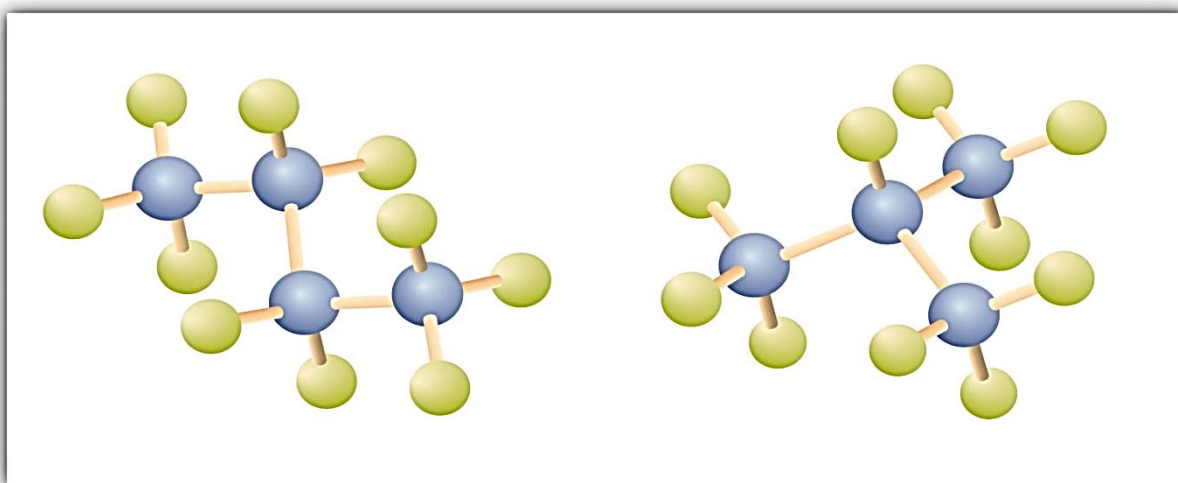
Objective: Given the steps and examples of naming branched alkanes, students will name the isomers of alkane members correctly.

Content

Steps to Naming Branched Alkanes

1. Count the longest continuous chain of carbons.

Consider the two carbon structures below. The two are the same structure, drawn differently. In either case, the longest continuous chain in this structure has eight carbons.



One carbon structure is drawn in two different ways

2. Number the carbons in the chain starting with the end that's closest to a branch.

To make sure you have done this step correctly, you can check your work by numbering the carbon chain from the opposite end as well. The correct numbering sequence is the one in which the substituent branches extend from the lowest-numbered carbons. For example, as it's drawn and numbered above, the alkane has substituent groups branching off of its third, fourth, and fifth carbons. If the carbon chain had been numbered backward, these would be the fourth, fifth, and sixth carbons in the chain. Because the first set of numbers is lower, the chain is numbered properly. The longest chain in a branched alkane is called the parent chain.

3. Count the number of carbons in each branch.

These groups (branches) are called alkyl groups and are named by adding the suffix *-yl* to the appropriate alkane prefix. The three most common alkyl groups are the methyl (one carbon), ethyl (two carbons), and propyl (three carbons) groups. Figure 1 has two methyl groups, one ethyl group, and no propyl groups.

Be careful when you find yourself dealing with alkyl groups made up of more than just a few carbons.

4. Attach the number of the carbon from which each substituent branches to the front of the alkyl group name.

For example, if a group of two carbons is attached to the third carbon in a chain like it is in Figure 1, the group is called an *-ethyl-* group. Since it is attached to the 3rd carbon it is called/ written as 3-ethyl.

5. Check for repeated alkyl groups.

If multiple groups with the same number of carbons branch off the parent chain, don't repeat the name. Rather, include multiple numbers, separated by commas, before the alkyl group name. Also, specify the number of instances of the alkyl group by using the prefixes *di-*, *tri-*, *tetra-*, and so on. For example, if one-carbon-groups (in other words, methyl groups) branch off carbons four and five of the parent chain, the two methyl groups appear together as "4,5-dimethyl."

6. Place the names of the substituent groups in front of the name of the parent chain in alphabetical order.

The correct name of the organic molecule in Figure 1 above is

3-ethyl-4,5-dimethyloctane.

Note: that hyphens are used to connect all the naming elements except for in the last connection to the parent chain (that is, *dimethyl-octane* would be wrong).

Table showing Alkyl Groups

Alkyl Group	Structure
methyl	CH ₃ —
ethyl	CH ₃ CH ₂ —

Note: Chemistry at CSEC level only requires you to know these two alkyl groups

Now, look at the table below for more examples of naming branched alkanes.

S.NO	COMPOUND	IUPAC NAME
1	$ \begin{array}{cccccc} & 5 & 4 & 3 & 2 & 1 \\ & \text{CH}_3 & -\text{CH}_2 & -\text{CH}_2 & -\text{CH} & -\text{CH}_3 \\ & & & & & \\ & & & & \text{CH}_3 & \end{array} $	2- Methyl pentane
2	$ \begin{array}{cccccc} \text{CH}_3 & -\text{CH} & -\text{CH}_2 & -\text{CH} & -\text{CH}_3 \\ 1 & 2 & 3 & 4 & 5 \\ & & & & \\ & \boxed{\text{CH}_3} & & \boxed{\text{CH}_3} & \end{array} $	2,4- Dimethyl pentane
3	$ \begin{array}{cccccc} & & & \boxed{\text{CH}_3} & & \\ & & & & & \\ \text{CH}_3 & -\text{CH}_2 & -\text{C} & -\text{CH}_2 & -\text{CH}_3 \\ 12 & & 3 & 4 & 5 \\ & & & & \\ & & \boxed{\text{CH}_3} & & \end{array} $	3,3- Dimethyl pentane
4	$ \begin{array}{cccccc} \text{CH}_3 & -\text{CH} & -\text{CH}_2 & -\text{CH}_2 & -\text{CH}_3 \\ 1 & 2 & 3 & 4 & 5 \\ & & & & \\ & \text{CH}_3 & & \text{CH}_2 & \\ & & & & \\ & & & \text{CH}_2 & \\ & & & & \\ & & & \text{CH}_3 & \end{array} $	3-Ethyl-2-methylpentane
5	$ \begin{array}{cccccccc} \text{CH}_3 & -\text{CH}_2 & -\text{CH} & -\text{CH} & -\text{CH} & -\text{CH}_2 & -\text{CH}_2 & -\text{CH}_3 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ & & & & & & & \\ & & \boxed{\text{CH}_2} & \boxed{\text{CH}_2} & \boxed{\text{CH}_2} & & & \\ & & & & & & & \\ & & \boxed{\text{CH}_3} & \boxed{\text{CH}_2} & \boxed{\text{CH}_2} & & & \\ & & & & & & & \\ & & & \boxed{\text{CH}_3} & \boxed{\text{CH}_3} & & & \end{array} $	3-Ethyl-4,5-dipropyl octane
6	$ \begin{array}{cccc} \text{CH}_3 & -\text{CH} & -\text{CH} & -\text{CH}_3 \\ & & & \\ & \text{CH}_2 & \text{CH}_3 & \\ & & & \\ & \text{CH}_3 & & \end{array} $	2,3 - Dimethylpentane
7	$ \begin{array}{cccccccc} \text{CH}_3 & -\text{CH} & -\text{CH}_2 & -\text{CH}_2 & -\text{CH} & -\text{CH}_2 & -\text{CH} & -\text{CH}_3 \\ & & & & & & & \\ & \text{CH}_3 & & & \text{CH}_2 & & \text{CH}_3 & \\ & & & & & & & \\ & & & & \text{CH}_3 & & & \end{array} $	4 - Ethyl - 2,7 - Dimethyloctane

References

https://www.brainkart.com/article/Nomenclature-and-isomerism-of-Alkanes_36488/

<http://padakshep.org/otp/subjects/chemistry/organic-chemistry/alkanes-nomenclature/>