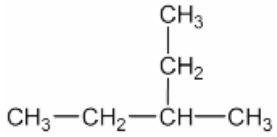
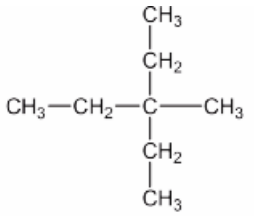
# 6. Nomenclature of organic compounds

## Let us Assess

### 1. Question

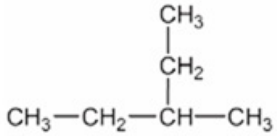
Mark the main chains in the compounds given below.



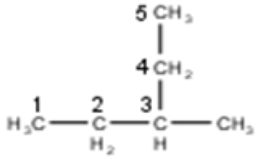


### Answer

(i) The given compound is:



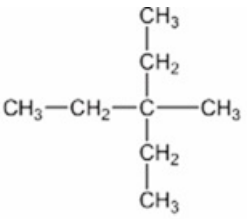
The numbering of main chain in the above compound is given by:-



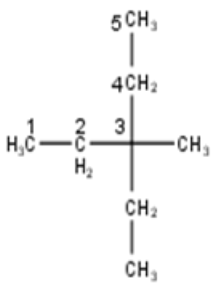
3-methylpentane

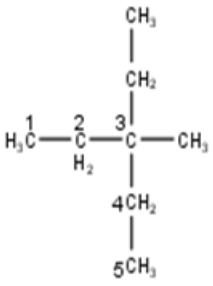
The main chain has been chosen containing the largest number of carbon atoms and giving the substituent bearing carbon the lowest number.

(ii) The given compound is:



The numbering of main chain in the above compound is given by:-

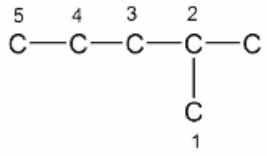


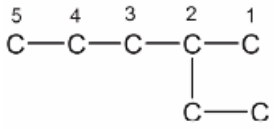


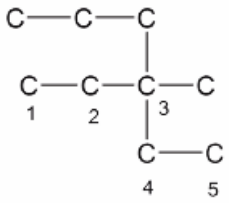
The main chain has been chosen containing the largest number of carbon atoms and giving the substituent bearing carbon the lowest number. Here two ways of numbering are there as shown in the structures above but either way we get the same length of the main chain and position of the two substituents. Hence, any one of the way can be chosen for numbering the main chain.

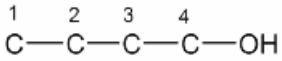
### 2. Question

See how the carbon chains are numbered. Correct the wrong ones.

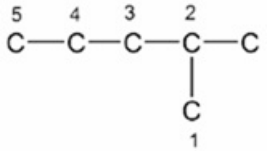
a) 

b) 

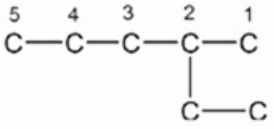
c) 

d) 

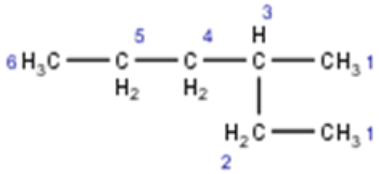
**Answer**

a. 

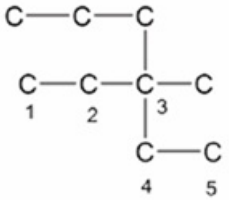
The carbon atoms are numbered correctly in the above structure.

b. 

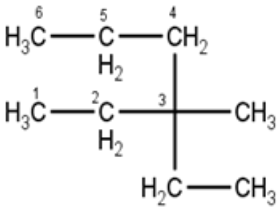
The carbon atoms are not numbered correctly in the above structure. The correct numbering is as shown in the following picture: -

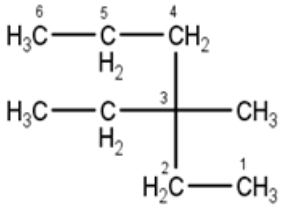


The numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent the lowest number possible.

c. 

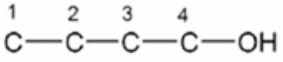
The carbon atoms are not numbered correctly in the above structure. The correct numbering is as shown in the following picture: -



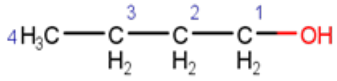


The numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent the lowest number possible. Here two ways of numbering are there as shown in the structures above but either way we get the same length of the main chain and position of the two substituents. Hence, any one of the way can be chosen for numbering the chain.

d.



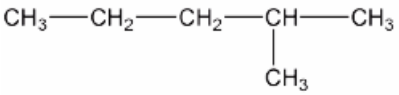
The carbon atoms are not numbered correctly in the above structure. The correct numbering is as shown in the following picture: -



The numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the functional group the lowest number possible.

**3 A. Question**

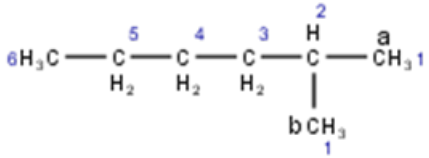
Write down the IUPAC names of the compounds given.



**Answer**

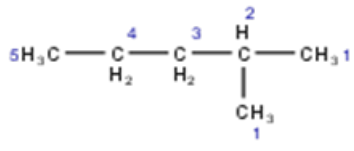
The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here there are two ways of reaching at the longest chains and both the routes gives the same length i.e. of 5 carbon atom as the longest chain.



2. One route starts with the carbon atom labelled a and the other route starts with the carbon atom labelled b. From whichever route we start we get the methyl substituent at the 2$^{nd}$ carbon atom.

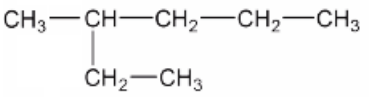
3. Hence, the IUPAC name is 2- methyl pentane.



2-methylpentane

**3 B. Question**

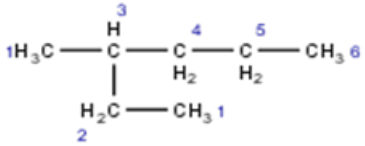
Write down the IUPAC names of the compounds given.



**Answer**

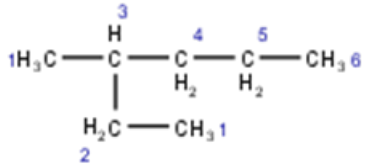
The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, the longest chain constituents of 6 carbon atoms and it is a saturated hydrocarbon. Hence, the word root is hexane.



2. Now upon numbering we find that the substituent which is the methyl group here is attached at the 3rd carbon.

3. Hence, the name derived is 3-methylhexane.



3-methylhexane

**3 C. Question**

Write down the IUPAC names of the compounds given.

$CH_3—CH_2—CH = CH—CH_2—CH_2—CH_3$

**Answer**

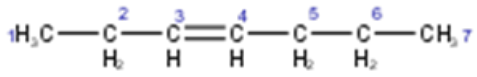
The IUPAC names of the given compounds with the proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, the longest chain is having 7 C atoms.

2. Hence, the word root is "hept".

3. Now, there is an unsaturation between the 3rd and 4th carbon atoms which is a double bond so a suffix "ene" is required to be added.

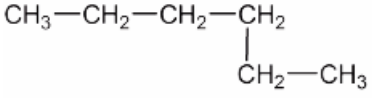
4. ∴ The name is hept-3-ene.



hept-3-ene

**3 D. Question**

Write down the IUPAC names of the compounds given.

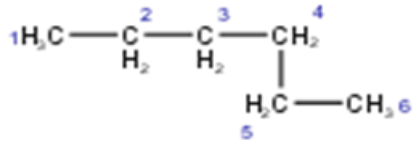


**Answer**

The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, the longest chain is having 6 Carbon atoms and there is no branching or substitution by functional group.

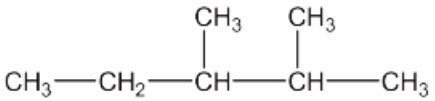
2. Hence, the IUPAC name is hexane



hexane

**3 E. Question**

Write down the IUPAC names of the compounds given.



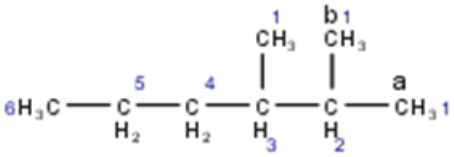
**Answer**

The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here there are two ways of reaching at the longest chains and both the routes gives the same length i.e. of 6 carbon atom as the longest chain.

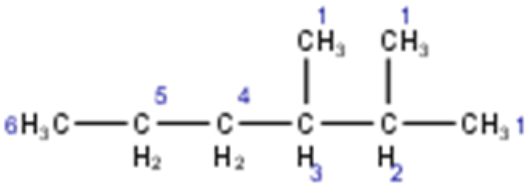
2. So, as no double or triple bond is there the word root is hexane.

3. One route starts with the carbon atom labelled a and the other route starts with the carbon atom labelled b. From whichever route we start we get the methyl substituents at the 2$^{nd}$ and 3$^{rd}$ carbon atoms.



4. Since two methyl groups are there so the prefix di is added followed by the position of them.

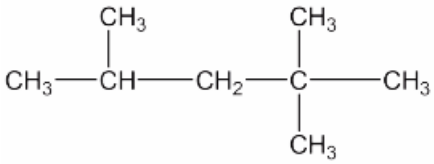
5. Hence, the IUPAC name is 2,3-dimethylhexane.



2,3-dimethylhexane

**3 F. Question**

Write down the IUPAC names of the compounds given.

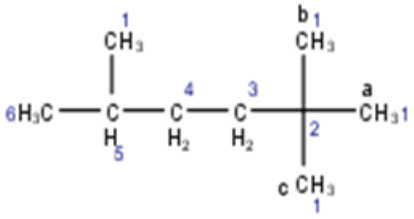


**Answer**

The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, there are three ways of reaching at the longest chains and all the routes gives the same length i.e. of 6 carbon atom as the longest chain.

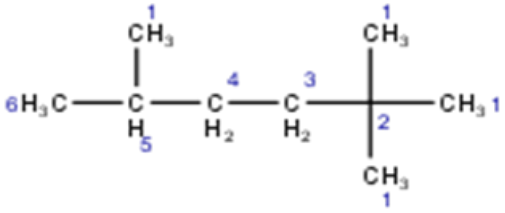
2. So, as no double or triple bond is there the word root is hexane.



3. One route starts with the carbon atom labelled a, other route starts with the carbon atom labelled b and the last route starts with carbon atom labelled c. From whichever route we start we get the two methyl substituents at the 2nd position and a 3rd methyl substituent at the $5^{th}$ carbon atom.

4. Since three methyl groups are there so the prefix tri is added followed by the position of them.

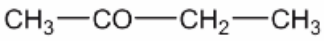
5. Hence, the IUPAC name is 2, 2, 5-trimethylhexane



2,2,5-trimethylhexane

**3 G. Question**

Write down the IUPAC names of the compounds given.



**Answer**

The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, the longest chain is having 4 carbon atoms.

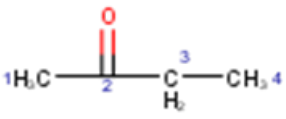
2. Hence, the word root is but.

3. Now, it is saturated. Hence, we get butane.

4. There is a keto group in the $2^{nd}$ carbon.

5. Hence e is removed from butane and one is added prefixed by its position.

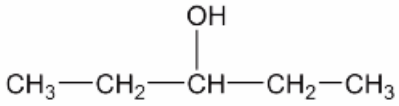
6. Hence, the IUPAC name is butan -2- one.



butan-2-one

**3 H. Question**

Write down the IUPAC names of the compounds given.



**Answer**

The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, the longest chain is having 5 carbon atoms.

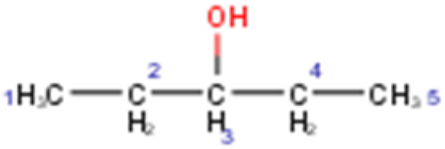
2. Hence, the word root is pent.

3. Now, it is saturated. Hence, we get pentane.

4. There is an alcohol group in the 3$^{rd}$ carbon.

5. Hence e is removed from pentane and ol is added prefixed by its position.

6. Hence, the IUPAC name is pentan-3-ol.



pentan-3-ol

**3 I. Question**

Write down the IUPAC names of the compounds given.

$CH_3—CH_2—CH_2—CH_2—Cl$

**Answer**

The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, the longest chain is having 4 carbon atoms.

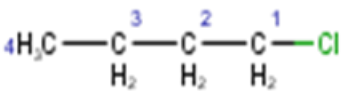
2. Hence, the word root is but.

3. Now, it is saturated. Hence, we get butane.

4. There is a Chloro(Halo) group in the 1$^{st}$ carbon.

5. Hence butane is prefixed by chloro which is prefixed by its position.

6. Hence, the IUPAC name is 1-chlorobutane.



1-chlorobutane

**3 J. Question**

Write down the IUPAC names of the compounds given.

$CH_3—CH_2—CH_2—COOH$

**Answer**

The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

1. At first we find the longest chain of the carbon atom. Here, the longest chain is having 4 carbon atoms.

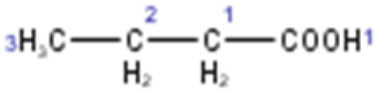
2. Hence, the word root is but.

3. Now, it is saturated. Hence, we get butane.

4. There is a carboxyl group in the 1$^{st}$ carbon.

5. Hence e is removed from butane and oic acid is added.

6. Hence, the IUPAC name is butanoic acid.



butanoic acid

**4. Question**

Write down the structural formulae of compounds given below.

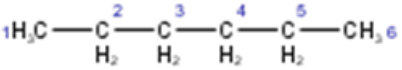
a. 3-ethyl-2-methylhexane

b. But-2-ene

**Answer**

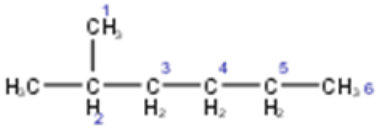
a. The structural formula of 3-ethyl-2-methylhexanecan be derived as follows: -

1. At first we have to find the parent chain. Here the parent chain is hexane. Hence we draw a hexane first : -



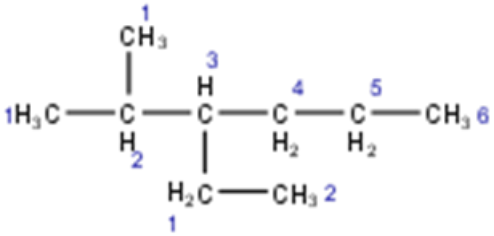
hexane

2. Then in the next step we find the position of the substituent and the substituent attached to the parent chain. Her, we have 2 substituents one ethyl group at 3$^{rd}$ position and one methyl group at 2$^{nd}$ position. Adding them stepwise we get after adding methyl group : -



2-methylhexane

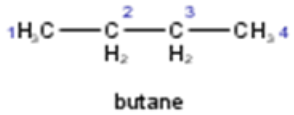
After adding the ethyl group we get the final molecule as : -



3-ethyl-2-methylhexane

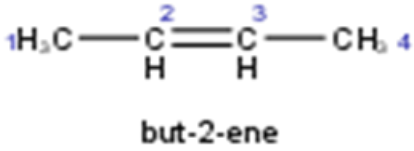
b. The structural formula of But-2-ene can be elucidated as follows: -

1. At first we have to find the parent chain which in this case is a 4 membered carbon ring so let us first draw a butane:



butane

Now from the name But-2-ene we come to know that it is an alkene with a double bond in between 2nd and 3rd carbon. Hence, we derived at the structure of But-2-ene as shown : -



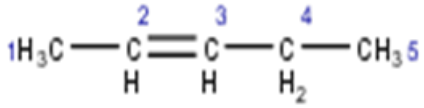
but-2-ene

**5. Question**

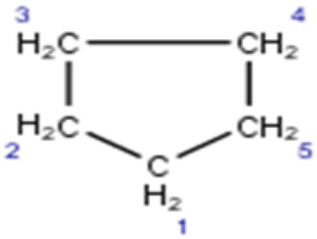
Write down the structural formula of the compound $C_5H_{10}$. Also write the structural formula of one of its isomers which is an alicyclic compound.

**Answer**

The structural formula of the compound $C_5H_{10}$ is as shown below: -



The structural formula of one of its isomers which is an alicyclic compound is as shown below: -



## Extended Activities

**1. Question**

Given below are certain hints about a hydrocarbon.

• The molecular formula is $C_5H_{10}$.

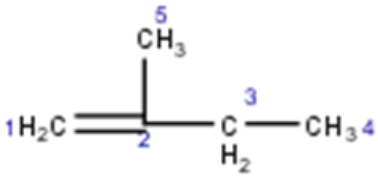
• Has a methyl radical as branch.

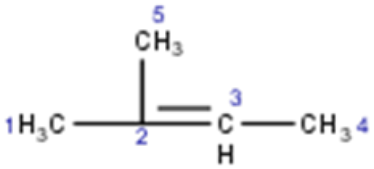
a) Write three possible structural formulae of this compound.

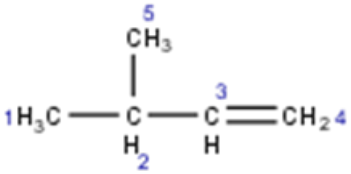
b) Write the IUPAC names of these structural formulae.

**Answer**

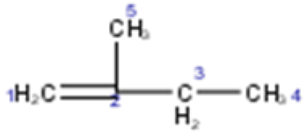
a. The three possible structural formulae of this compound are : -



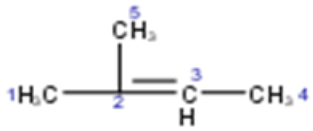




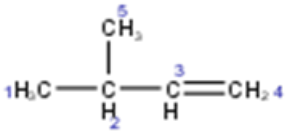
b. IUPAC names of these structural formulae are :-



2-methylbut-1-ene



2-methylbut-2-ene

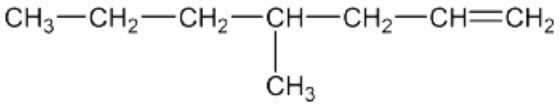


3-methylbut-1-ene

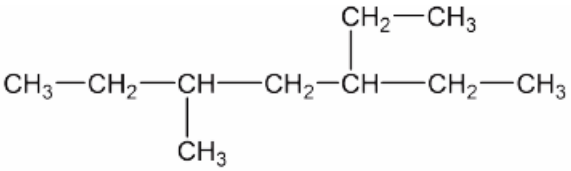
**2. Question**

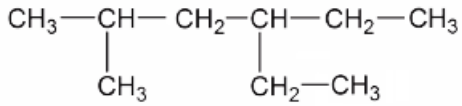
Write down the IUPAC names of the compounds given below

a)



b)



c) 

d) $CH_3—CH_2—CH_2—C \equiv CH$

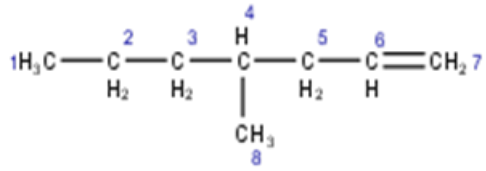
e) $CH_3—CH_2—CH_2—OH$

f) $CH_3—CH_2—O—CH_3$

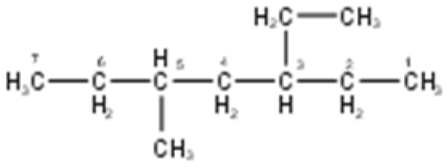
g) $CH_3—CH_2—CH_2—CH_2—CH_2–COOH$

**Answer**

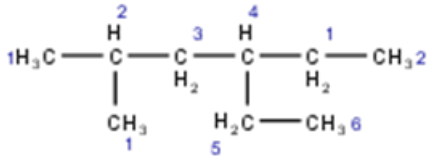
The IUPAC names of the given compounds with proper numbering of the main chain and the substituents keeping in mind the fact that the numbering is done so as to choose the longest branch of carbon and giving the carbon bearing the substituent or the functional group the lowest number as possible are as follows: -

a. 

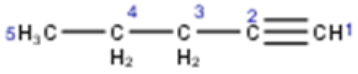
4-methylhept-1-ene

b. 

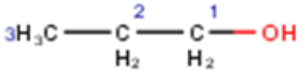
3-ethyl-5-methylheptane

c. 

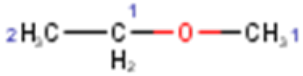
4-ethyl-2-methylhexane

d. 

pent-1-yne

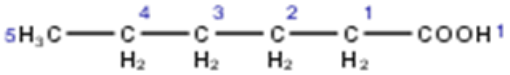
e. 

propan-1-ol

f. 

methoxyethane

g.



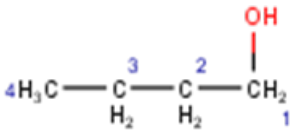
hexanoic acid

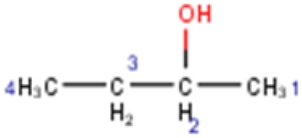
**3. Question**

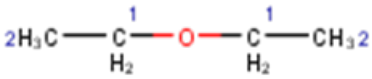
Write the structural formulae of all possible isomers of the compound with molecular formula $C_4H_{10}O$. Identify the different isomer pairs from them and find the type of isomerism to which each pair belongs.

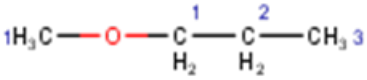
**Answer**

The structural formulae of all possible isomers of the compound with molecular formula $C_4H_{10}O$ are: -

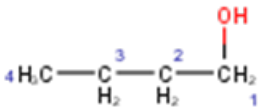


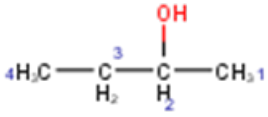




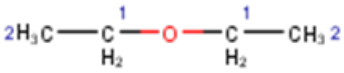


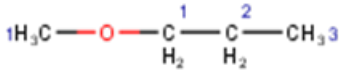
The different isomer pairs from the above shown isomers of the compound with molecular formula $C_4H_{10}O$ and the type of isomerism to which each pair belongs are : -





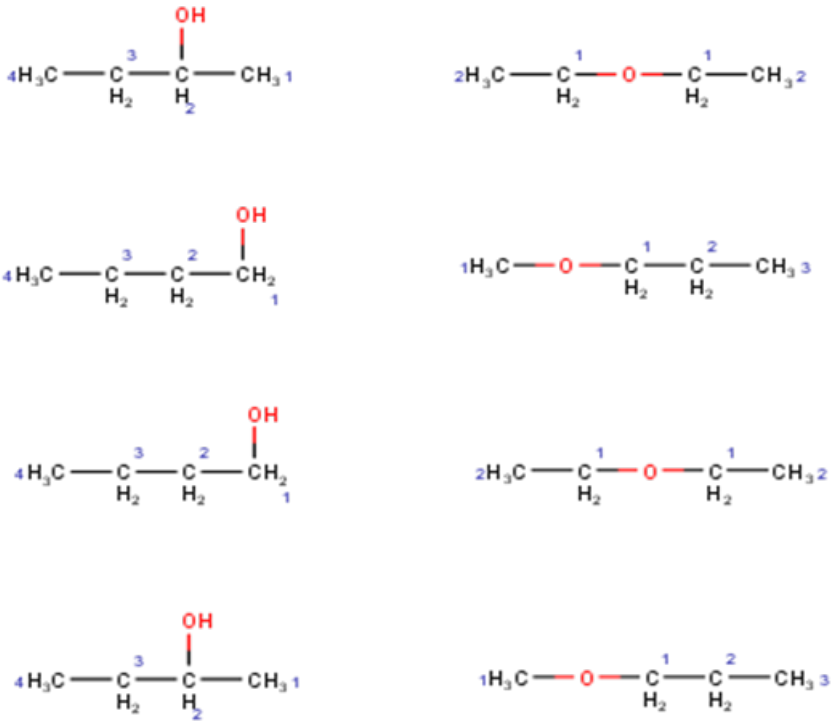
Positional Isomers





Positional isomers

The following are the pairs of functional isomers : -



Functional Isomers

**4. Question**

Find three pairs of isomers from the compounds given below. Identify the type of isomerism to which each pair belongs.

a) Propan-1-ol

b) 2,2,3,3-Tetramethylbutane

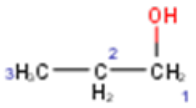
c) Octane

d) Propan-2-ol

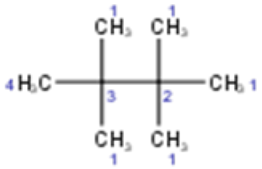
e) Methoxyethane

**Answer**

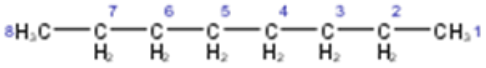
The structures of all the compounds given above are: -



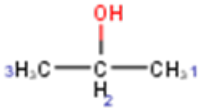
a



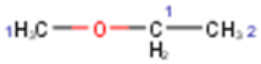
b



c

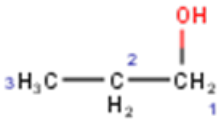


d

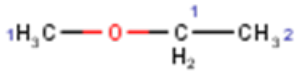


e

Three pairs of isomers from the above compounds and the type of isomerism to which each pair belongs are:
-

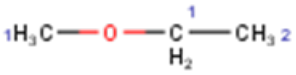


a

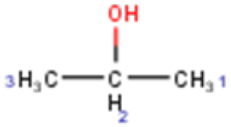


e

Functional Isomers

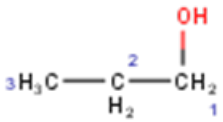


e

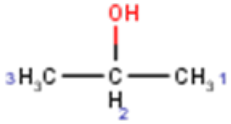


d

Functional Isomers



a



d

Position Isomers

**5. Question**

The structural formulae of two organic compounds are given.

(i) $CH_3—O—CH_2—CH_3$

(ii) $CH_3—CH_2—CH_2—OH$

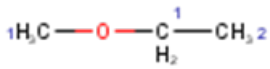
a) What are the IUPAC names of these compounds?

b) Write one similarity and one difference between these two compounds.

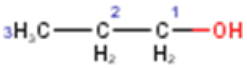
c) What is this phenomenon known as?

**Answer**

a. The IUPAC names of these compounds are:-



methoxyethane



propan-1-ol

b. One similarity between these two compounds is-

They have the same molecular formula.

One difference between these two compounds is-

They have different functional groups attached to them.

c. This phenomenon is known as isomerism or more specifically functional isomerism in which the compounds have the same molecular formula but different functional groups attached to them.

**6. Question**

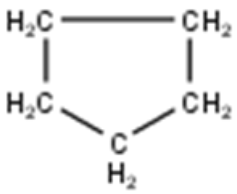
Write down the structural formulae of the following compounds.

a) Cyclopentane

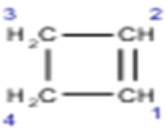
b) Cyclobutene

**Answer**

The structural formulae of the given compounds are-

a. 

cyclopentane

b. 

cyclobutene