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# Chemistry

## SUB. CODE- BSCC2402

*For B.Sc. 4<sup>th</sup> Semester*

**(Terpenes)**  
**Module-VII**

***Terpenoids: Classification and Isoprene rule***

*By*

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# Terpenoids

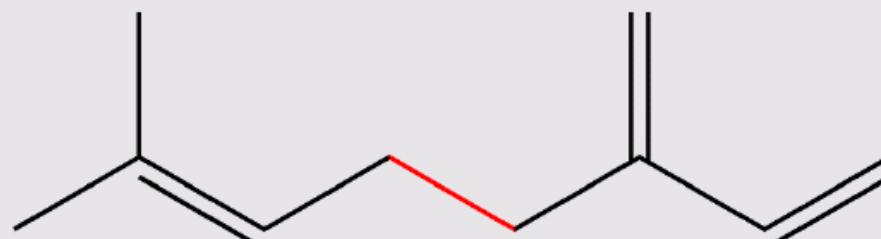
Terpenes, or terpenoids, are a large class of plant secondary products with a major role in defense against plant-feeding insects and herbivores.

However, not all terpenoids act as secondary products. Many have important roles in primary processes, such as photosynthesis, stability of **cell membranes**, signaling, and as source compounds for several **plant hormones**.



# Terpenoids: Isoprene Unit

Terpenes are characterized by their basic structural element, the five-carbon **isoprene** unit:





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# Terpenoids: Classification

Terpenes may be considered to be made up of isoprene (isopentane) units, an empirical feature known as the **isoprene rule**. Because of this, terpenes usually have  $5n$  carbon atoms ( $n$  is an integer), and are subdivided as follows:

Classification	Isoprene Units	Carbon Atoms
monoterpenes	2	C <sub>10</sub>
sesquiterpenes	3	C <sub>15</sub>
diterpenes	4	C <sub>20</sub>
sesterterpenes	5	C <sub>25</sub>
triterpenes	6	C <sub>30</sub>

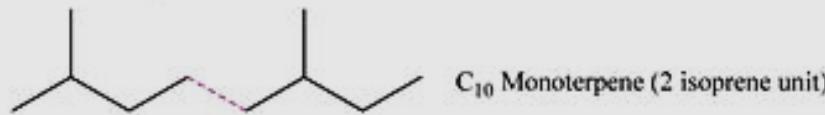


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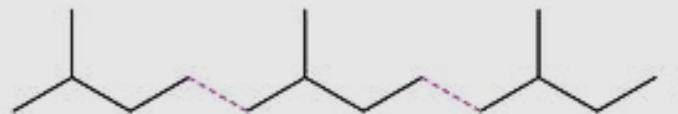
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C<sub>5</sub> Hemiterpene (1 isoprene unit)



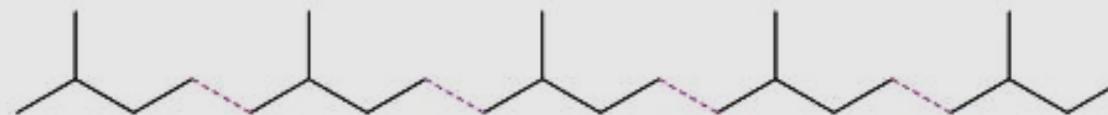
C<sub>10</sub> Monoterpene (2 isoprene unit)



C<sub>15</sub> Sesquiterpene (3 isoprene unit)



C<sub>20</sub> Diterpene (4 isoprene unit)



C<sub>25</sub> Sesterpene (5 isoprene unit)



C<sub>30</sub> Triterpene (6 isoprene unit)

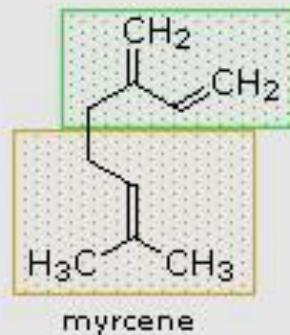
C<sub>40</sub> Tetraterpene (8 isoprene unit)



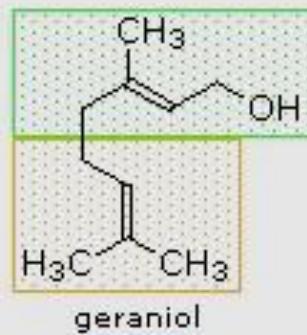
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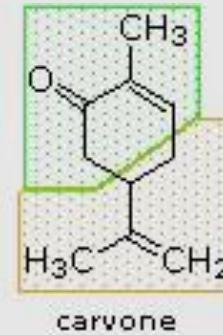
# Monoterpenes



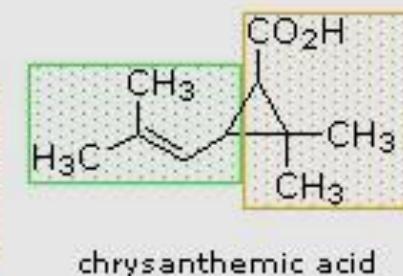
myrcene



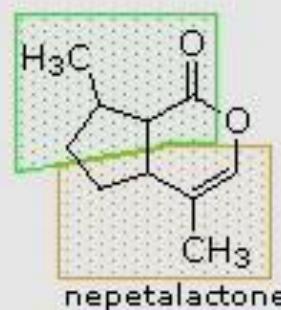
geraniol



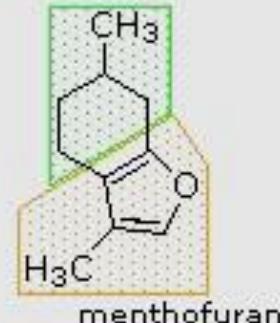
carvone



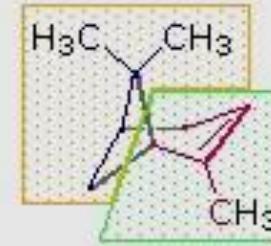
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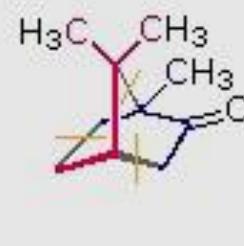
nepetalactone



menthofuran



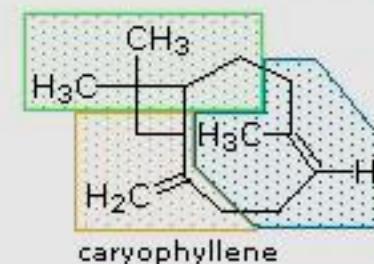
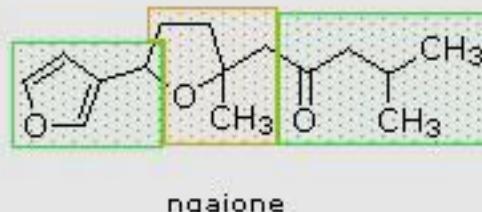
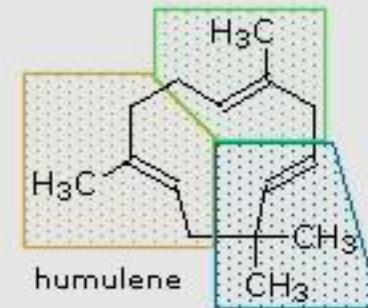
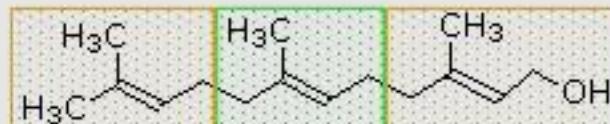
$\alpha$ -pinene



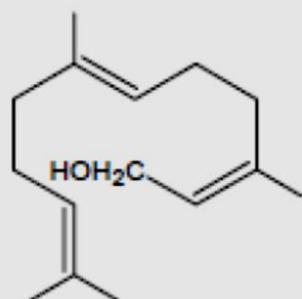
camphor



# Sesquiterpenes

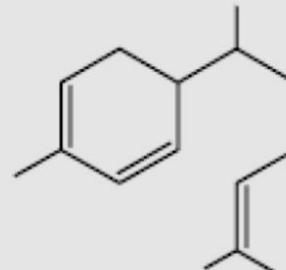


i) Acyclic sesquiterpenoids



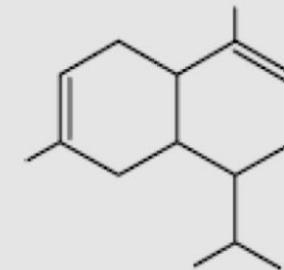
Farnesol

ii) Monocyclic sesquiterpenoids



Zinziberene

iii) Bicyclic sesquiterpenoids.



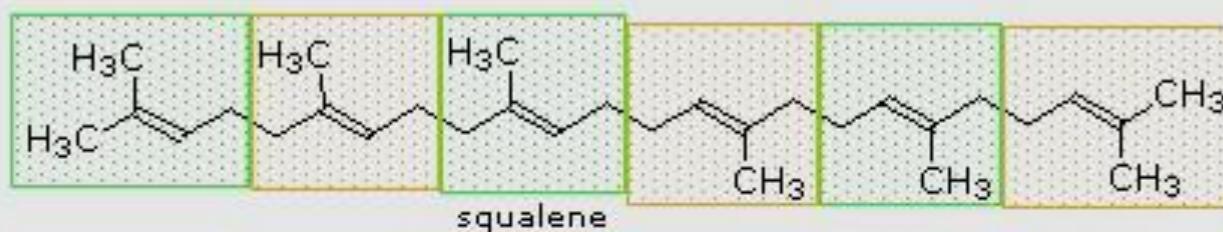
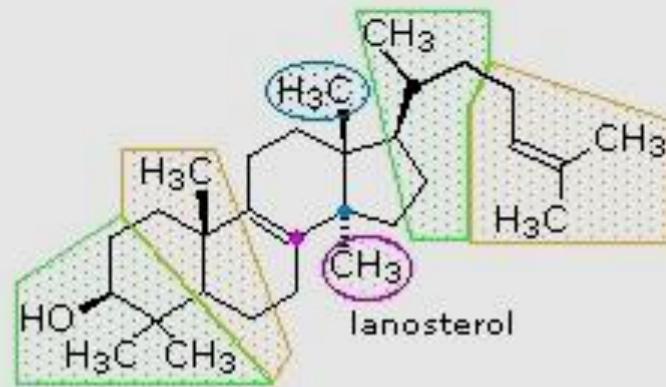
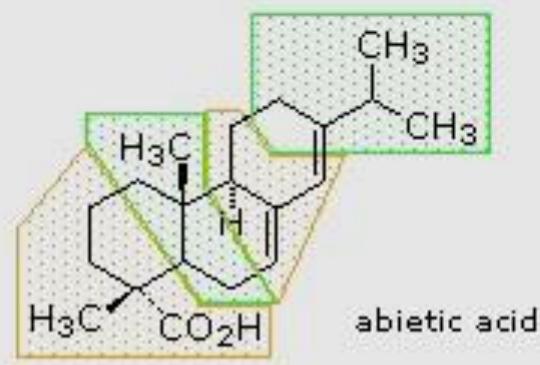
Cadinene



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# Di- and Triterpenes





## 1-1 Linkage

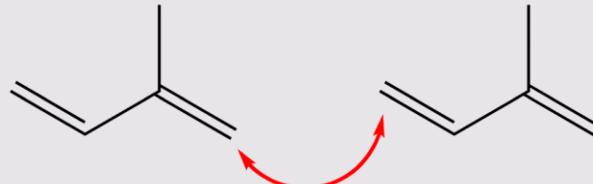
The head of one isoprene molecule could link with the head of another isoprene molecule.



**Figure 1:** This link is called a head-to-head or 1-1 link.

## 1-4 Linkage

The head of one isoprene molecule could link with the tail of another isoprene molecule.



**Figure 2:** This link is called a head-to-tail or 1-4 link.



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## 4-4 Linkage

The tail of one isoprene molecule could link with the tail of another isoprene molecule.



**Figure 3:** This link is called a tail-to-tail or 4-4 link.

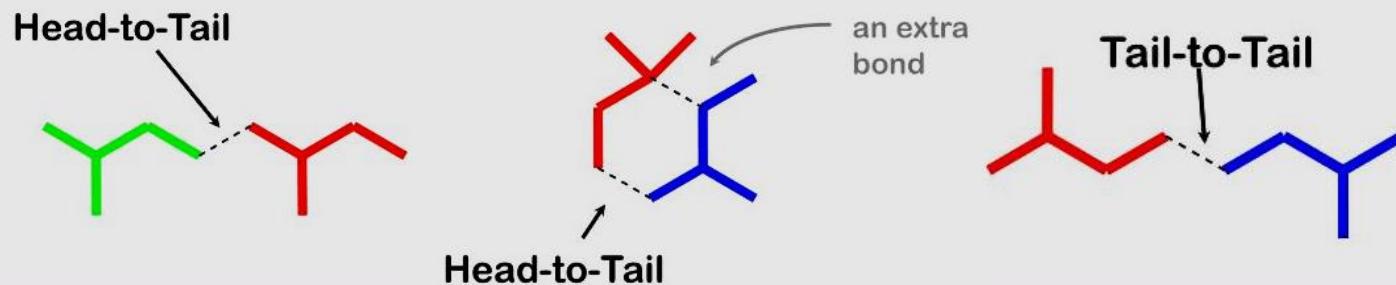
Cyclic terpenes also contain links that are neither 1-1, 1-4, nor 4-4, which are called *crosslinks*.



## The isoprene rule

This **rule** proposed by Ingold in 1925.

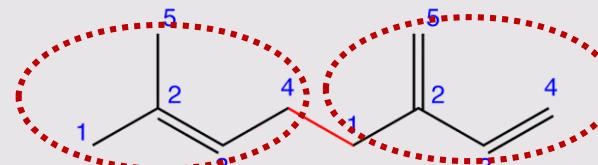
According to this **rule** “the **isoprene** units in terpenoids are joined by head to tail linkage or 1,4- linkage ( The branched end of **isoprene** unit was considered as head and other end as the tail)



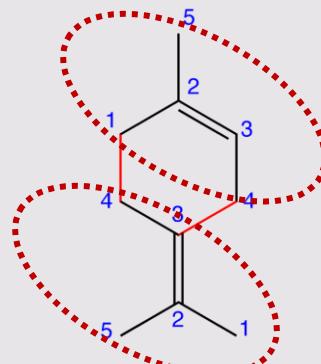
The isoprene rule states that, in most naturally occurring terpenes, there are no 1-1 or 4-4 links.



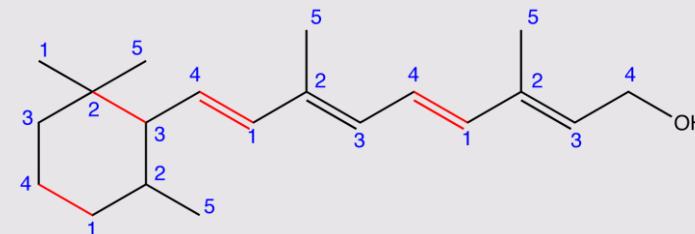
*Myrcene*



*Limonene*

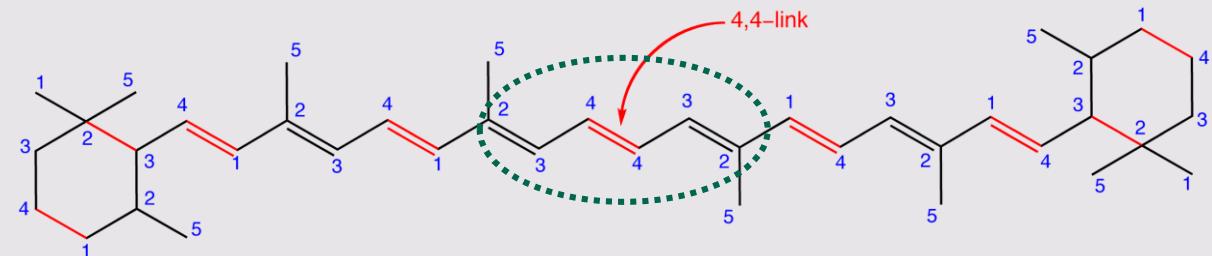


*Retinol*



*A terpene that does not obey the isoprene rule is called an irregular terpene. eg:*

*$\beta$ -Carotene*





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## References

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1. K.D Sharma and Y. R. Sharma, Kalyani Publishers, Unit-III page-319;
2. University Chemistry, Vol-IV, Dr. U. N. Dash, Dr. K. K. Ojha, Himalaya Publishing house, Unit V, page-408