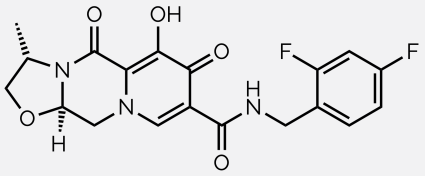
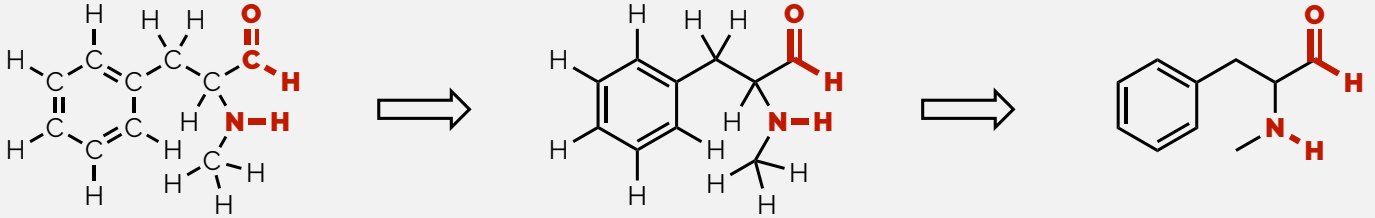
Drawing molecules

1. Introduction



Organic chemists use **line** drawings or **skeletal structures** to represent molecules. These drawings codify a lot information in clean, simple drawings & are based on **Lewis structures**.

2. Structural representation to skeletal (line) diagram



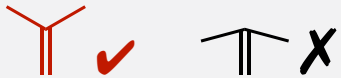
Structural diagram
Skeletal diagrams emphasise the functional groups within a molecule.

Intermediate stage
First, ignore the carbon labels but leaving the bonds so that it is clear where the carbon atoms should be

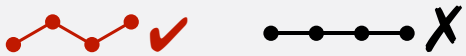
Skeletal or line diagram
Then ignore all C–H bonds, removing the hydrogen labels and the bonds. Retain all hydrogen–heteroatom bonds.

3. Clean structures

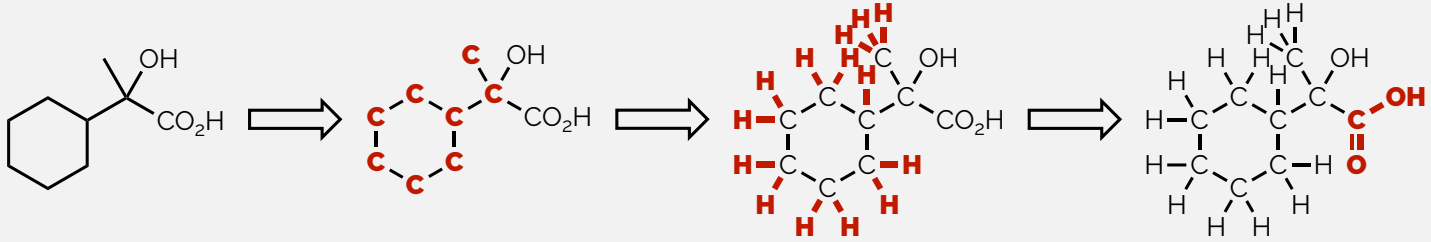
i. Bonds coming off multiple bonds should be far apart



ii. Single bonds should be a zig-zag



4. Skeletal diagram to full structural representation



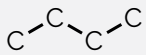
Add carbon atoms
The end of each line or kink in a chain is a carbon atom - add the label

Add hydrogen atoms
All carbon atoms have four bonds if neutral. If less than four bonds are shown add C–H until four bonds achieved

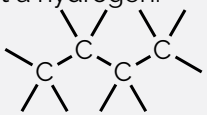
Condensed formula
The condensed formula shows all atoms. You cannot add hydrogen to get correct number of bonds. (C=4; N=3; O=2)

5. Errors

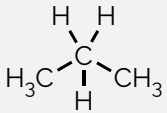
i. Never show just the carbon atoms. This is meaningless to a chemist.



ii. Never remove only the hydrogen atoms. The end of a line is a carbon atom not a hydrogen.



iii. Never draw a pentavalent carbon.



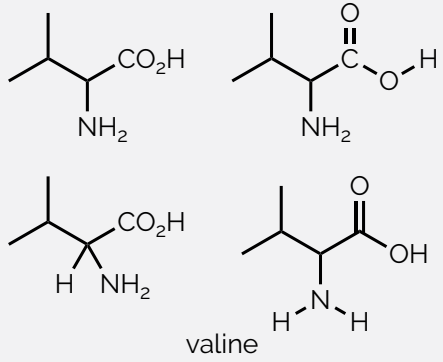
iv. Get the shape right. It is a zig-zag if all single bonds otherwise maximise separation of bonds

6. Conclusion

Skeletal or line diagrams simplify structures making it easy to see what functional groups are present.

There are many ways of drawing a molecule and chemists will show carbon or hydrogen atoms if they are relevant to the discussion.

Line diagrams also have to show three-dimensional shape but that is a discussion for another day.



valine