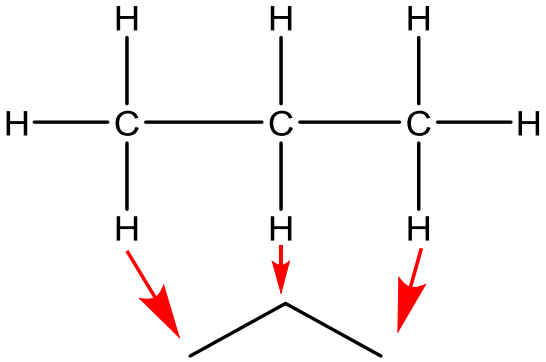
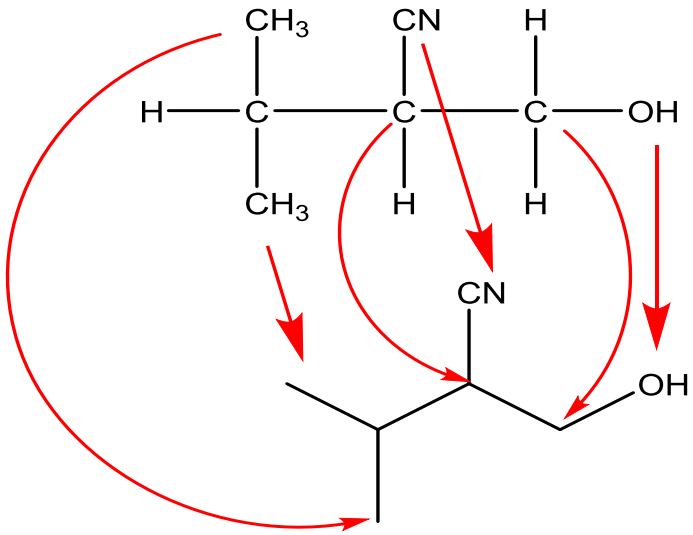
There are many types of formulae used by chemists, including molecular, structural, displayed (graphical) and skeletal. The most universal formulae used worldwide is skeletal, which is used as the most quick and effective way of drawing chemical structures at all universities and some schools all around the world. However, many school exam boards cover little or no skeletal formulae with their students. This sheet is designed to help you understand what the skeletal formulae on the worksheets and the WebCSD interface are showing about the chemicals and how to draw them. After you have read this sheet, try the question sheet to make sure you fully understand it.

Rules of Skeletal Formulae

1. All of the hydrogen atoms that would be usually joined onto a carbon chain are removed. The carbon atoms are also not drawn and are represented with lines; the end/junction of each line represents a carbon atom.



2. Any additional group or atom excluded carbon and hydrogen are drawn in. However, there are exceptions, the nitrile functional group C≡N becomes CN, as shown in the example to the right.



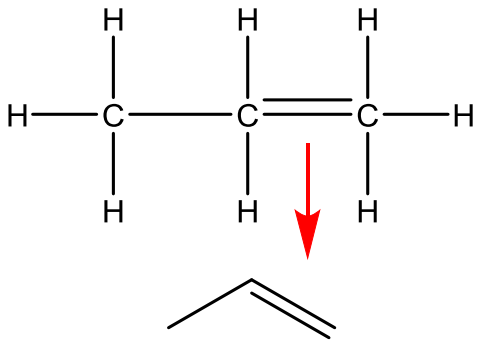
TOP TIP!

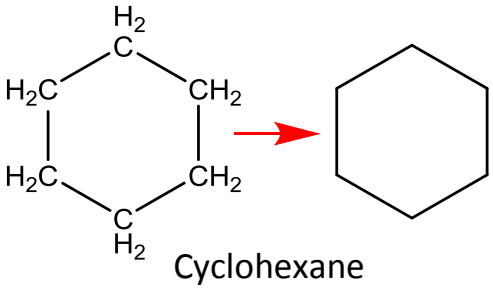
Remember that each line junction represents a carbon atom. The amount of hydrogen atoms bonded to the carbon atom will be 4 minus the amount of bonds to that carbon already. A carbon atom can only have 4 bonds!

www.flickr.com/photos

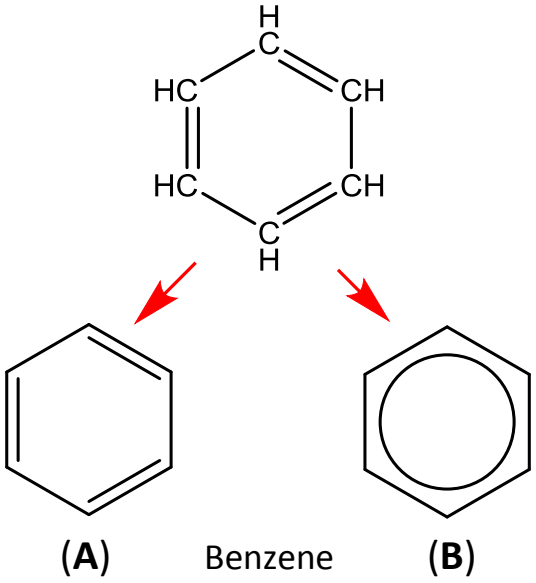
Further Points

Double bonds are also represented in skeletal formulae. The double bond is simply drawn as two lines between carbon atoms (=). A single line for ethane would become two parallel lines (like an equal sign but longer).



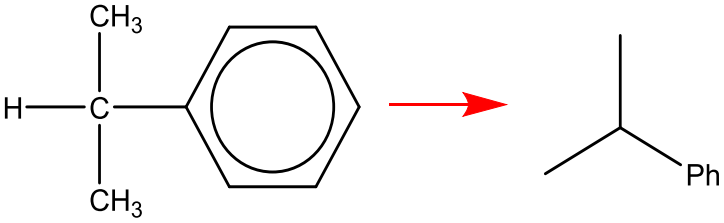


Cyclohexane



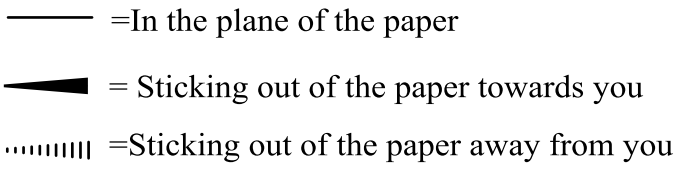
(**A**) Benzene (**B**)

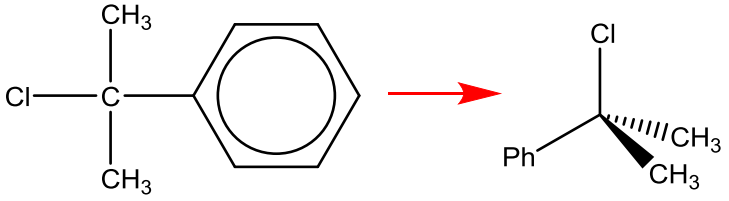
Benzene and cyclohexane can also be represented using skeletal formulae, as seen in the diagrams to the left. Benzene can be drawn in two ways; (**A**) is the 'Kekule' structure usually drawn at University level whilst (**B**), the delocalised ring structure, is usually preferred at school examinations level. Both cyclic molecules are drawn as skeletal formula at school level, mainly to save time. When benzene is included in a skeletal formula, it is included like a functional group is included and is represented by 'Ph' (**Ph**enyl), shown below.



3D Representations of Molecules

No matter what level of chemistry you are studying you will be required to draw 3D molecules and there are simple rules for this. A normal line is a bond in the same plane as the paper, a wedge means that the bond is sticking out of the paper towards you and a hashed line means that the bond is sticking out behind the paper.





Produced by Steven Carman at Newcastle University as part of a MChem project.