Basic Concepts in Organic Chemistry: Further Reading

You may think that the IUPAC naming system for organic compounds will help you to understand the lists of contents on cosmetics and processed foods. However, although examiners use the correct systematic names in setting questions, the wider world has taken little interest, even though the IUPAC system was laid down in the 1970s.

Manufacturers have advanced beyond the first attempt at agreed naming, proposed in the late eighteenth century by Louis-Bernard Guyton de Morveau, who hoped that his system would 'help the intelligence and relieve the memory'. Although sulphuric acid is no longer referred to by the picturesque name 'oil of vitriol', manufacturers continue to use pre-1970s names. Thus, a bottle of vinegar is said to contain acetic acid, rather than ethanoic acid. Ethanoic acid is usually supplied to laboratories under the old name too. Antifreeze for a car is referred to as glycol or ethylene glycol instead of the correct name, ethane-1,2-diol. The alcohol in drinks is just called alcohol, even though it is just one member of this homologous series. Sometimes, it is written as ethyl alcohol. This hints that the molecule contains two carbon atoms, but the correct name 'ethanol' should be used. As well as ethanol, wine contains acids, such as tartaric acid, more correctly known as 2,3-dihydroxybutanoic acid. Small crystals may form at the bottom of a wine bottle, owing to precipitation of potassium hydrogentartrate, which is known to cooks as 'cream of tartar:

Sometimes the systematic name is too long for general usage. For example, to say a person has a raised 10,13-dimethyl-1 7-(6-methylheptan-2-yl)-2,3,4,7,8 ,9,1 1, 1 2,14,1 5,16,1 7-dodecahydro-1 *H*-cyclopenta[α]phenanthren-3-ol level is more cumbersome than 'raised cholesterol'. This can apply to the E-numbers used in foods, which vary from the simple (E290, carbon dioxide; E520, magnesium oxide) to the complex (E612, the flavour enhancer monosodium glutamate the monosodium salt of 2-aminopentanedioic acid). Biologists deal with complex substances and use the old names - for example, 'glycine', rather than aminoethanoic acid for the simplest amino acid.

The old names have influenced the newer system. For example, we refer to poly(ethene) or polythene, which indicates that it has been made by combining many ethene molecules. A better name would be - polythane because the polymer does not contain any double bonds.

Potential confusion is not restricted to organic compounds. Some cookery books list sodium bicarbonate as an ingredient. This suggests that it contains two carbonate groups for each sodium atom - a problem solved by using the correct name, sodium hydrogencarbonate.

A* Questions

It is difficult to be sure that you have identified all the isomers for a given formula.

It also easy to write two formulae that are, in fact, the same.

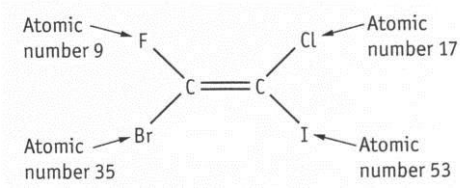
a) Draw all the isomers of C_5H_{10} that are alkenes. Identify any that are *E/Z* isomers.

b) Name the isomers in part (a).

c) Draw all the isomers of formula $C_2ClBrIF$.

Naming the compounds in part (c) requires the following rules. For each carbon atom on either side of the double bond, determine the atomic numbers of the substituents. If the two highest numbers are on the same side of the molecule, the compound is a (*Z*)-isomer; if they are on opposite sides, it is an (*E*)-isomer.

For example consider the compound:



Here, the two atoms with the highest atomic numbers, Br and I, are on the same side of the molecule - the molecule is named '*Z*'. If they had been on different sides, it would have been named '*E*'.

The full name is (*Z*)-1-bromo-2-chloro-1-fluoro-2-iodoethene. Substituents are listed in alphabetical order and the relevant numbers are then added to show their positions.

d) Using the above example as a guide, name the isomers you have drawn in answer to part (c).