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Short Communication

A Short Note on Alkanes & Cycloalkanes

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ABSTRACT

Hydrocarbons are alkanes or cycloalkanes, depending on whether the carbon atoms of the molecule are arranged only in chains or also in rings.

Organic compounds with only C-C and C-H single (s) bonds are called alkanes, with general formula showing: $C_nH(2n+2)$.

If the C-C bonding occurs in ring shape, then they are termed as cycloalkanes (C_nH_{2n}).

Hydrocarbons do not contain functional groups, they constitute the framework on which functional groups are located in other classes of compounds, which is an initiator for studying and naming organic compounds.

Keywords: Hydrocarbons; Alkanes; Cycloalkanes

INTRODUCTION

Alkanes and cycloalkanes are termed as saturated, because they incorporate the maximum number of hydrogens possible without breaking any carbon-carbon bonds. They are also members of a larger class of compounds referred to as aliphatic [1].

IUPAC Nomenclature

Rules to write a name of a compound. IUPAC with essential features are:

A molecular structure with a chain of carbon atoms that forms a structure.

Any functional group, that may be included as a suffix

Other substituent groups to be named other than hydrogen atoms.

Alkanes and their reactivity

Alkanes consists of strong carbon-carbon single bonds and strong carbon-hydrogen bonds. The carbon-hydrogen bonds are less slightly polar and so there aren't any bits of the molecules which carry any significant amount of positive or negative charge which other things might be attracted to.

For example, in many organic reactions you may find (or perhaps already know) that reactions starts because an ion or a polar molecule is attracted to a part of an organic molecule which carries some positive charge or negative charge. This doesnot happen with alkanes, because alkane molecules donot have this separation of charge.

Cycloalkanes and their reactivity

Cycloalkanes are very similar to the alkanes in reactivity, except for the very small ones - especially cyclopropane. Cyclopropane is much more reactive than you would expect.

The reason has to do with the bond angles in the ring. Normally, when carbon forms four single bonds, the bond angles are about 109.5°. In cyclopropane, they are 60°. With the electron pairs this close together, there is a lot of repulsion between the bonding pairs joining the carbon atoms. That makes the bonds easier to break. The effect of this is explored on the page about reactions of these compounds with halogens which you can access from the alkanes menu below.

Heat of Combustion

we might expect isomers to have similar heats of combustion contrast to this, belief is proved wrong. For example: heat of combustion of pentane is −782 kcal/mole, but that of its 2,2-dimethylpropane (neopentane) isomer is −777 kcal/mole.

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Differences such as this tells about minute structural variations, including the greater bond energy of 1° C–H versus 2° C–H bonds and steric crowding of neighboring groups. In small-ring cyclic compounds ring strain can be a major contributor to thermodynamic stability and chemical reactivity. The following table shows heat of combustion data for some simple cycloalkanes and compares these with the increase per CH_2 unit for long chain alkanes.

Cycloalkanes

The reactions of the cycloalkanes are generally just the same as the alkanes, excluding particularly cyclopropane. In the presence of UV light, cyclopropane reacts with chlorine or bromine which are called substitution reactions just like a non-cyclic alkane. However, it also has the ability to react in the dark. In the absence of UV light, cyclopropane can undergo addition reactions in which the ring is broken. For example, with bromine, cyclopropane gives 1,3- dibromopropane.

CONCLUSION

Thus, alkanes are very similar to the cycloalkanes in reactivity, except for considering very few as cyclopropane. Cyclopropane is much more reactive than you would expect. The reason has to do with the bond angles in the ring.

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