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Commentary

Short Notes on Elimination Reactions

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COMMENTARY

Elimination reactions

At sites that are isolated from carbonyls or other electron-withdrawing groups, elimination processes are also feasible. Two model methods can be used to describe this type of elimination: It is possible for it to happen in a single concerted step (proton abstraction). C-X bond cleavage occurs simultaneously with proton abstraction at the alpha-carbon), or in two processes (C-X bond cleavage occurs first, forming a carbocation intermediate, which is subsequently 'quenched' by proton abstraction at the alpha-carbon).

These pathways, known as E2 and E1, are significant in laboratory organic chemistry but less so in biological chemistry. The identification of the R groups (i.e., whether the alkyl halide is primary, secondary, tertiary, etc.) as well as the properties of the base will determine which mechanism occurs in a laboratory reaction, as discussed below.

E1 and E2 reactions in the laboratory

E2 elimination processes in the laboratory are carried out with relatively strong bases, such as alkoxides (deprotonated alcohols). When 2-bromopropane interacts

With ethoxide, for example, propene is generated. The SN1 and E1 processes are unlikely to work with primary carbo-cations since they are relatively unstable.

The type of electron-rich species is also critical. Acetate, for example, is a weak base but an excellent nucleophile, and will react with 2-bromopropane predominantly as a nucleophile.

The same carbocation-favoring conditions that are used in SN1 reactions are used in E1 reactions: a secondary or tertiary substrate, a protic solvent, and a moderately weak base/nucleophile. In fact, E1 and SN1 reactions frequently occur at the same time.

After the synthesis of a common carbocation intermediate, a combination of substitution and elimination products is produced. When tert-butyl chloride is mixed with ethanol and water, for example, it produces a mixture of SN1 (tert-butyl alcohol and tert-butyl ethyl ether) and E1 (2-methylpropene) products.

The Hoffman elimination is a well-studied E2 elimination using a quaternary amine as the leaving group; note that the quaternary amine has no proton that may protonate the reaction's base.

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