Practical General Chemistry

Lecture notes

Presented by

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eighth Lecture: Hydrolysis of disaccharides by acids

Hydrolysis is any chemical reaction in which a molecule of water ruptures one or more chemical bonds. The term is used broadly for substitution, elimination, and fragmentation reactions in which water is the nucleophile.

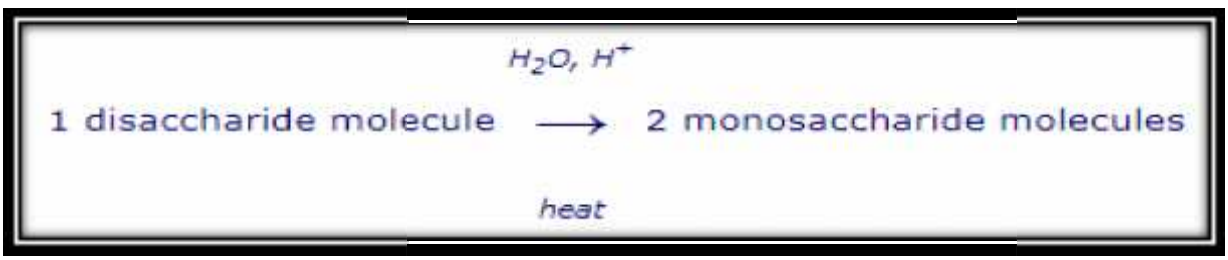
Biological hydrolysis is the cleavage of biomolecules where a water molecule is consumed to effect the separation of a larger molecule into component parts. When a carbohydrate is broken into its component sugar molecules by hydrolysis (e.g. sucrose being broken down into glucose and fructose).

NOTE :- Hydrolysis is a reaction with water.

Hydrolysis reactions are also referred to as hydrolytic reactions.

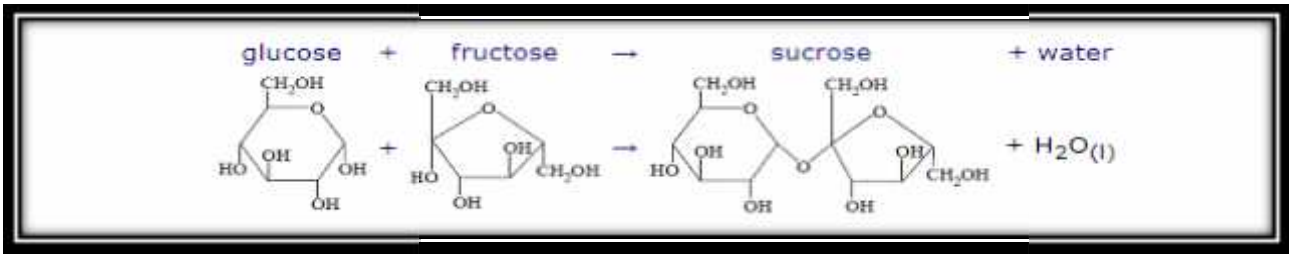
Acid hydrolysis is a reaction with acidified water (acidic conditions).

Disaccharides can be hydrolysed under acidic conditions.



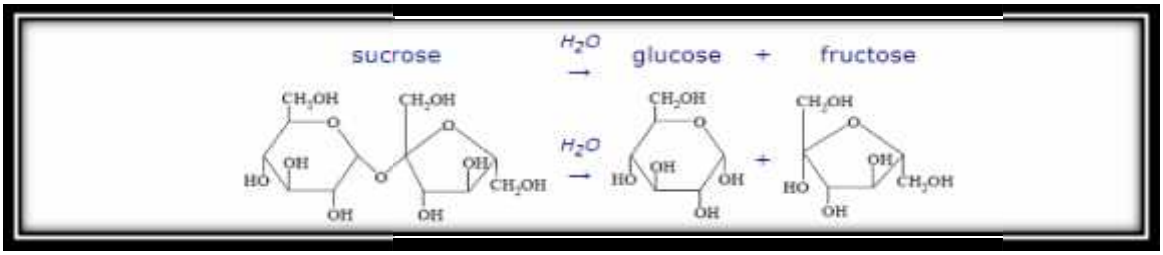
Hydrolysis of Disaccharides

Sucrose, table sugar, is an example of a disaccharide. It is produced by the condensation reaction between the monosaccharides glucose and fructose as shown below:



Notice the -C-O-C- (glycosidic link or ether bond) between the glucose unit and the fructose unit in a molecule of sucrose.

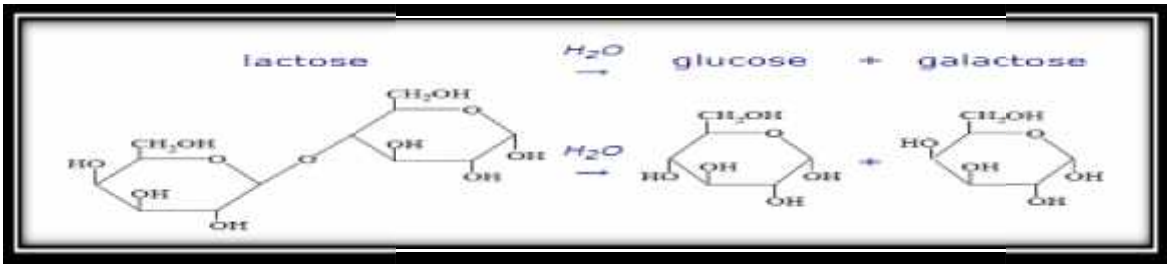
The reverse reaction is the hydrolysis of sucrose to produce glucose and fructose:



Notice that a water molecule has effectively been added across the glycosidic link resulting in the formation of two monosaccharides; glucose and fructose.

In the laboratory we would use heat and acidic conditions to hydrolyse sucrose, but in your body you use an enzyme, sucrase, in an enzyme catalysed hydrolysis reaction.

Lactose, "milk sugar", is also a disaccharide that can undergo hydrolysis:



Notice that a water molecule has effectively been added across the glycosidic link resulting in the formation of two monosaccharides; glucose and galactose.

In the laboratory we would use heat and acidic conditions to hydrolyse lactose, but in your body you use an enzyme, lactase, in an enzyme catalysed hydrolysis reaction.

For every 1 molecule of disaccharide that undergoes hydrolysis, 2 molecules of monosachharide are produced.

1 disaccharide molecule $\xrightarrow{H_2O}$ 2 monosaccharide molecules