



CARBOHYDRATES REACTIONS MONOSACCHARIDES REACTIONS DISACCHARIDES REACTIONS

First stage

college of Dentistry

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Measurement and evaluation strategies

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graph TD; A[Measurement and evaluation strategies] --> B[Formative assessment (during learning): direct questions and discussions, short tests, group work, video]; A --> C[Final assessment (after the learning is completed): written and electronic tests, research reports, presentations.]; A --> D[Self-assessment and feedback, questionnaires, peer reviews, immediate teacher feedback];
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Formative assessment
(during learning): direct questions and discussions, short tests, group work, video

Final assessment (after the learning is completed): written and electronic tests, research reports, presentations.

Self-assessment and feedback,
questionnaires, peer reviews, immediate teacher feedback

Evaluation Strategy



Quiz



Assignment



Group activity

What is the differences between these images ?



Introduction

**•Carbohydrates are one of the four major classes of biomolecules, alongside proteins, lipids, and nucleic acids
They are defined by their chemical structure, which is based on carbon, hydrogen, and oxygen atoms**

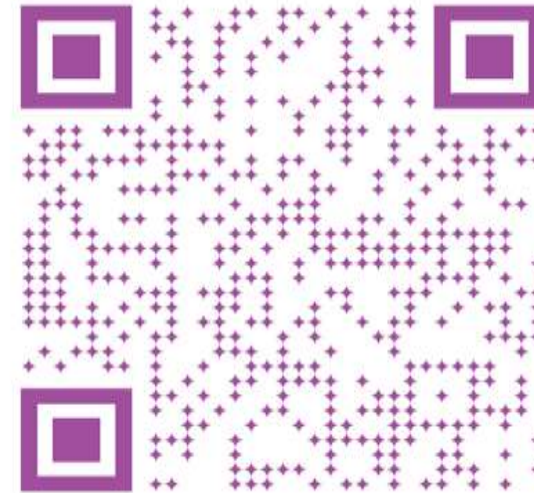
The name **"carbohydrate"** literally means "hydrate of carbon," as many of these compounds have the empirical formula $C_n(H_2O)_n$ simplification, as some carbohydrates contain nitrogen or sulfur, and the ratio of hydrogen to oxygen isn't always 2:1

The fundamental chemical nature of carbohydrates lies in them being polyhydroxy aldehydes (aldoses) or polyhydroxy ketones (ketoses), or substances that can be broken down to form such compounds.

Carbohydrates are primarily classified into four major groups based on the number of monomer units they contain

Listen to this video:

https://youtu.be/zjZv86n4TZA?si=1Lb0hz_obB7z08jI



Carbohydrates

Carbohydrates – 3 types

Monosaccharide

Simple sugar

Glucose

Fructose

galactose

Disaccharides

Maltose

Sucrose

lactose

polysaccharides

starch

cellulose

glycogen



Monosaccharides (Simple Sugars)

These are the simplest carbohydrates and are the •
basic building blocks for all other carbohydrates.
They cannot be hydrolyzed into smaller sugar units.
Their general formula is $(\text{CH}_2\text{O})_n$, where n is typically
between 3 and 7

Based on the number of carbon atoms, they are named as •
trioses (3 carbons), tetroses (4), pentoses (5), hexoses (6),
etc.

They are also classified by the type of carbonyl group they contain:

Aldoses: Contain an aldehyde functional group (—CHO), such as glucose and galactose.

Ketoses: Contain a ketone functional group (>C=O), such as fructose.

Disaccharides

Composed of two monosaccharide units joined together by a glycosidic bond . This bond is formed through a dehydration (condensation) reaction, where a molecule of water is removed

Examples include: •

Sucrose : Glucose + Fructose (α,β -1,2-glycosidic bond). Known as table sugar •

Lactose : Glucose + Galactose (β -1,4-glycosidic bond). Found in milk

Maltose : Glucose + Glucose (α -1,4-glycosidic bond). Found in malt •



Task

Answer the question from the link:

<https://www.menti.com/al29jbk1ta3v>

or scan the QR :



Oligosaccharides

Contain a short chain of 3 to 10 monosaccharide units linked by glycosidic bonds. •

These are often found attached to proteins and lipids on cell membranes, where they play important roles in cell recognition and signaling.

Examples includes: raffinose and stachyose.

Polysaccharides (Complex Carbohydrates)

Long polymers consisting of many monosaccharide units (hundreds or thousands) linked together.

They are classified by their function:

Storage Polysaccharides •

The primary energy storage form in plants. It is a polymer of glucose • with two forms: amylose (unbranched, α -1,4 linkages) and amylopectin (branched, with α -1,6 linkages at branch points).

Glycogen: The main energy storage form in animals. It is a highly • branched polymer of glucose with α -1,4 and α -1,6 linkages, similar in structure to amylopectin but with more frequent branching.

Structural of Polysaccharides

Cellulose: A major component of plant cell walls. It is a linear polymer of glucose units linked by β -1,4-glycosidic bonds. This type of linkage makes cellulose highly stable and indigestible by most animals, including humans.

Chitin: A polymer of a modified glucose unit (N acetylglucosamine) and a major component of the cell walls of fungi and the exoskeletons of insects and crustaceans.

Key Chemical Properties

Stereoisomerism: Carbohydrates are rich in chiral centers, giving rise to numerous stereoisomers. The designation of a sugar as D or L is based on the configuration of the chiral carbon farthest from the carbonyl group. In biological systems, D-isomers are the most common.

Glycosidic Bonds: The formation of a glycosidic bond is a key chemical reaction in carbohydrate chemistry.

It is an ether linkage ($R-O-R'$) that joins two sugar units.

The type of bond (α or β) and the carbons involved (e.g., 1,4 or 1,6) determine the structure and function of the resulting polysaccharide

Reducing Sugars: Carbohydrates with a free hemiacetal or hemiketal group (an anomeric carbon not involved in a glycosidic bond) are considered **"reducing sugars"**

This is because the ring can open to expose the reactive aldehyde or ketone group, which can reduce other molecules

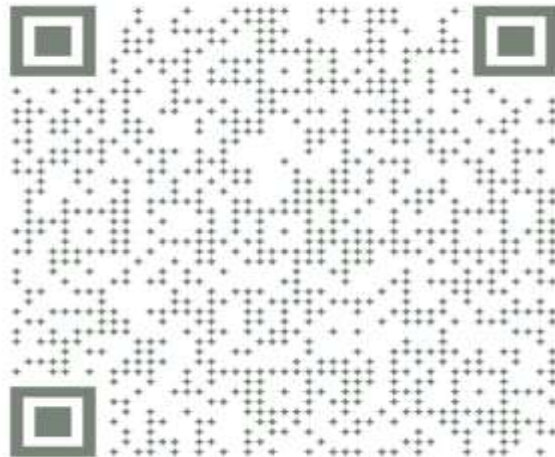
Monosaccharides and some disaccharides (like maltose and lactose) are reducing sugars, while others (**like sucrose**) are not.



Upload the solution in the link below: •

https://docs.google.com/forms/d/e/1FAIpQLSecjSw4H6mFvZvK-7kHeGp5EnYgZPTRzHBx_4i4kURqMsaojA/viewform?usp=header

or scan QR: •



Write a short report (200-300 words) answering the following prompt:

- Discuss the classification of carbohydrates into simple and complex forms.
- Explain how their chemical structure affects the rate of energy release in the human body, and provide two examples of each type found in daily diet



Assignment



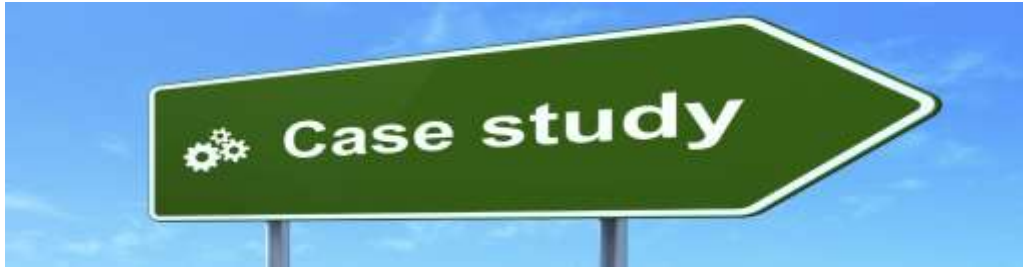
(10 min)

If you are feeling dizzy from low blood sugar, which carbohydrate is better for an immediate fix? And why



Conclusion

Carbohydrates are essential biomolecules that serve as a primary source of energy, structural components, and cellular recognition markers. They're composed of carbon, hydrogen, and oxygen atoms, typically in a 1:2:1 ratio, and are classified into three main groups: monosaccharides, disaccharides, and polysaccharides.



Sara is a 25-year old .amateur athlete who decided to run •
her first full marathon (42 km) .To feel “light” and avoid
feeling bloated during the race, she decided to eat only a
light green salad for dinner the night before the race.

During the race : She started with great energy and •
maintained a fast pace for the first hour.

After 90 minutes : Sara suddenly felt severe dizziness •
muscle weakness, and mental confusion (brain fog).

**Why did Sara collapse after 90 min even though she felt •
energetic at the start?**



References

- Berg, J. M., Tymoczko, J. L., & Stryer, L. (2007). *Biochemistry* (6th ed.). W. H. Freeman and Company. A standard biochemistry textbook that provides a thorough foundation in the structure, function, and metabolism of carbohydrates.
- Voet, D., Voet, J. G., & Pratt, C. W. (2016). *Fundamentals of Biochemistry: Life at the Molecular Level* (5th ed.). Wiley. Another widely used textbook that provides excellent detail on the chemical properties of carbohydrates and their biological roles.
- Sinnott, M. L. (2013). *Carbohydrate Chemistry and Biochemistry: Structure and Mechanism*. The Royal Society of Chemistry. This specialized textbook provides an in-depth look at the chemical reactivity and mechanisms of carbohydrates, suitable for advanced students and researchers.
- The Chemistry of Life: Carbohydrates. Khan Academy. An excellent online resource that provides a clear and visually engaging introduction to the basic chemistry of carbohydrates



THANK YOU
