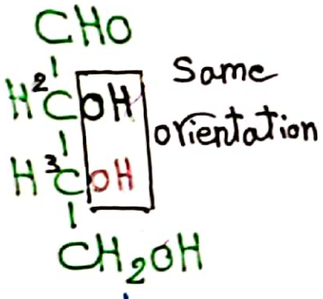
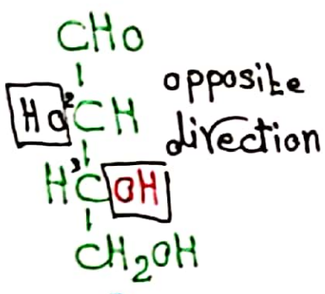
D-Erythrose



Same orientation

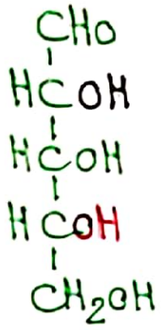
D-Threose



opposite direction

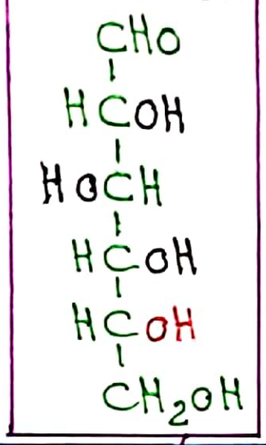
"Considered as Epimers"

D-Ribose

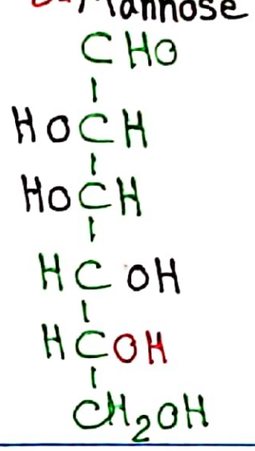


Essential energy source, ↑Known as blood sugar

D-Glucose

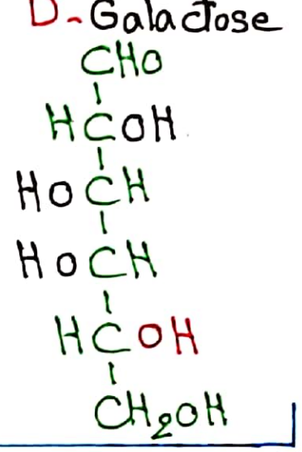


D-Mannose



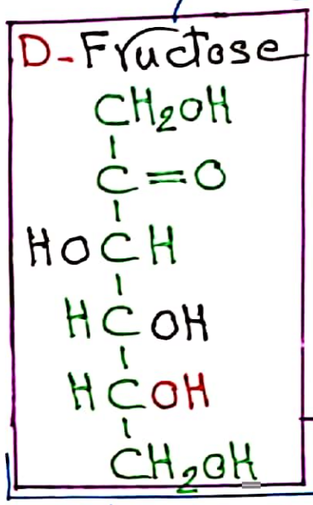
Rarely found naturally ↑as single sugar

D-Galactose



Sweetest sugar ↓ It can replace the table sugar or sucrose

D-Fructose

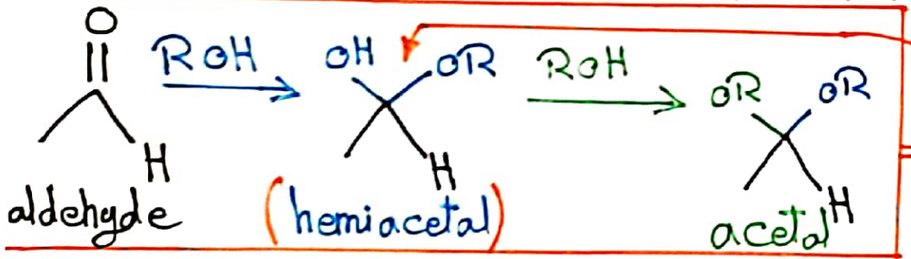


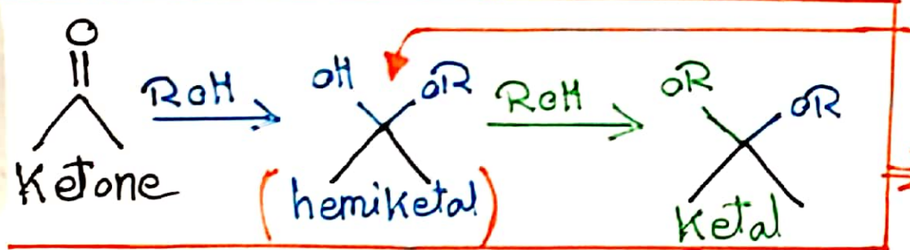
Aldoses (No. of carbon - 2 = No. of chiral center)

↳ The simplest one is Glyceraldehyde

* No. of isomers = 2^n, n: number of chiral carbon.

* D or L: based on the last chiral center "before last carbon in the molecule".



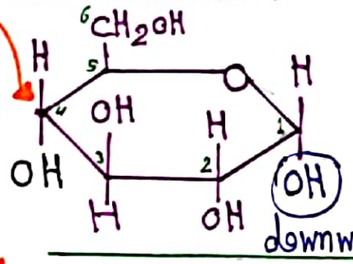


Ketoses

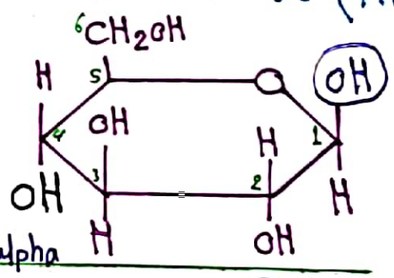
No. of carbon - 3 = No. of chiral center

The simplest one is Dihydroxyacetone

↳ doesn't have "D" or "L" because all carbons considered as (Achiral)



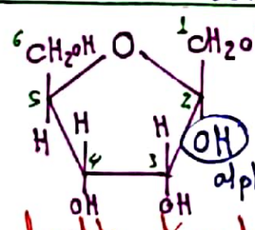
or



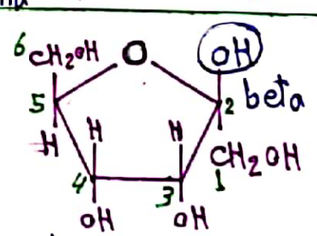
downward ⇒ alpha

upward ⇒ beta glucose ⇒ The most stable.

"The relation between alpha & beta is anomers"



or



alphaFructose ⇒ The most stable.

* Furan has five-membered ring but it has two double bonds.

* Pyran // six-membered ring // // // // // //.

* Chain to ring:-

Left → up

Right → down

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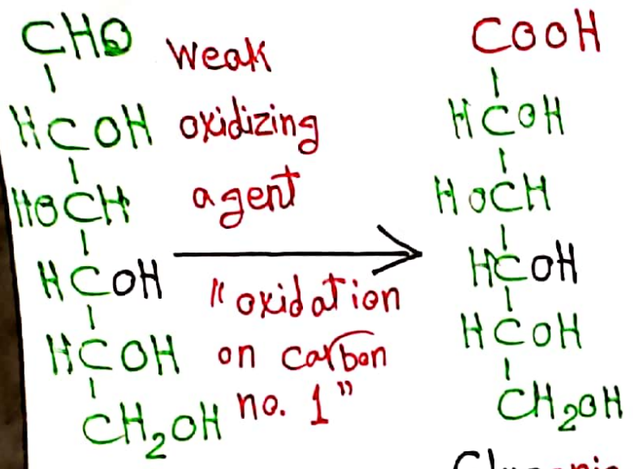
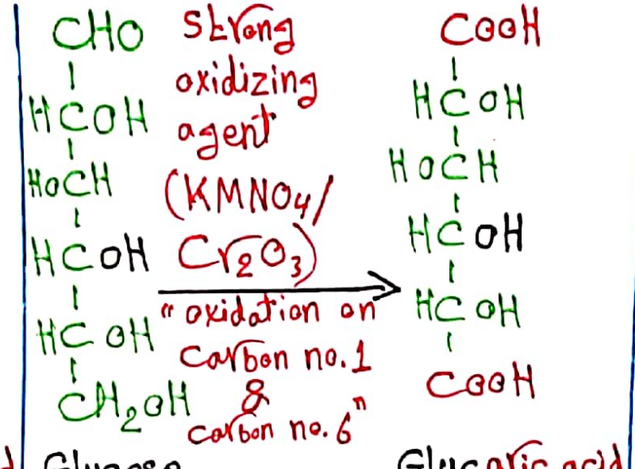
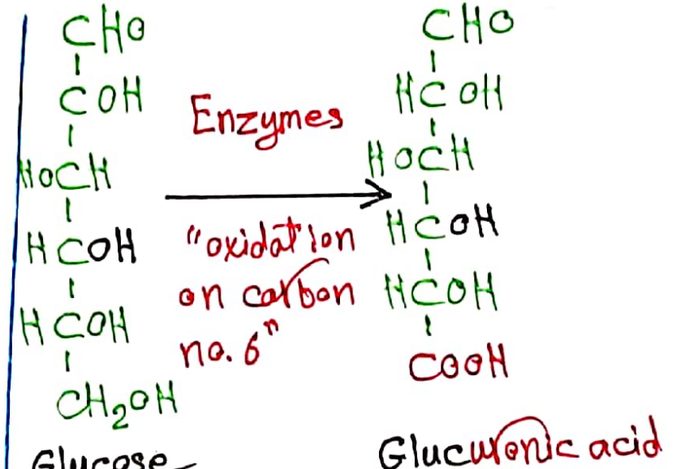


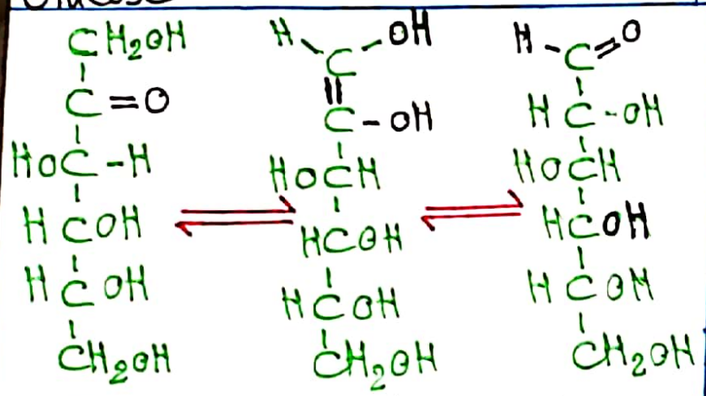
Glucose — Gluconic acid



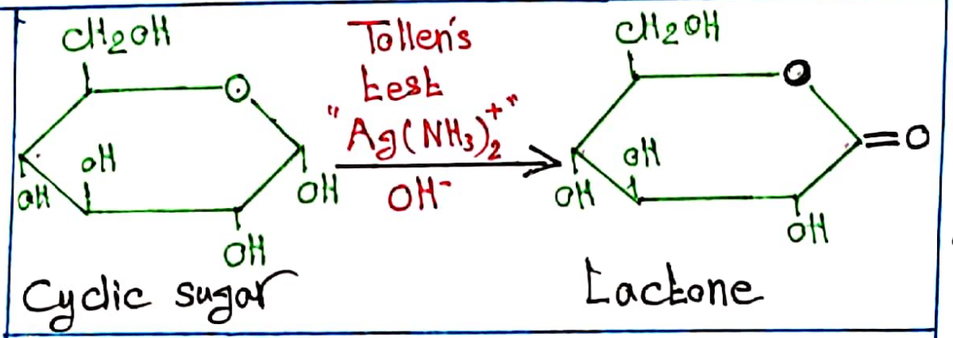
Glucose — Glucaric acid



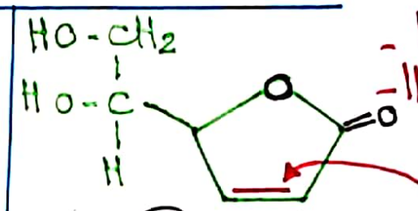
Glucose — Glucuronic acid



Fructose — ene-diol — Glucose



Cyclic sugar — Lactone



Ascorbic acid (Vitamin C)

- It's not a sugar
- It's an unsaturated lactone because of this extra double bond.
- Vitamin C deficiencies can lead to scurvy.
- It's important for immune system.

*Reduction of Ketoses:-

- D-glyceraldehyde or dihydroxyacetone ⟶ Glycerol
- Reduction C1 of glucose or C2 of fructose ⟶ D-Sorbitol
- Reduction of C2 of D-fructose or C1 of D-mannose ⟶ D-Mannitol
- Reduction of C1 of D-xylose or C2 of D-xylulose ⟶ D-Xylitol

*Monosaccharides: $C_n(H_2O)_n$

*Disaccharides: $C_n(H_2O)_{n-1}$

*Phosphorylation :-

- on C1 ↓ Glucose-1-phosphate "phosphoacetal"
- on C6 ↓ glucose-6-phosphate "phosphate ester"

*Sucrose: Glucose + Fructose
alpha $1^{\alpha} \longrightarrow 2\text{-}^{\beta}$ linkage
(Non reducing) "unable to get oxidized"

*Maltose: Glucose + Glucose
alpha $1^{\alpha} \longrightarrow 4^{\alpha}$ linkage
(Reducing sugar) "can get oxidized"

*Lactose: Galactose + Glucose
beta $1^{\beta} \longrightarrow 4^{\alpha}$ linkage
(Reducing sugar) "can get oxidized"

The shape of these linkages like the (V) letter in English

The shape of this linkage like the (N) letter in English

*Oligosaccharides :-

- Raffinose: Galactose + Glucose + Fructose
  $1 \longrightarrow 6$, $1 \longrightarrow 2$
- Streptomycin and erythromycin (antibiotics)
- Doxorubicin (cancer chemotherapy)
- Digoxin (cardiovascular disease)

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Polysaccarides

Storage

Glycogen (Glucose units) (in animals)
- Branching happens every 10 residues.
- In the main chain: alpha 1-4 linkage.
- In the branched chain: alpha 1-4 linkage.
- Between main and branched chain (branching point): alpha 1-6 linkage.
- It's a non-reducing sugar.

Dextran
- Synthesized by yeast and bacteria.
- alpha 1-6 linkage.
- Branches: 1-2, 1-3, or 1-4.

Starch (in plants) (Glucose units)

Amylose (10-20%)
- Connected via alpha 1-4 linkage.
- Doesn't have branching.

Amylopectin (80-90%)
- connected like glycogen (same linkages)
- Branching happens every 25 residues.

- Both are non-reducing sugars.

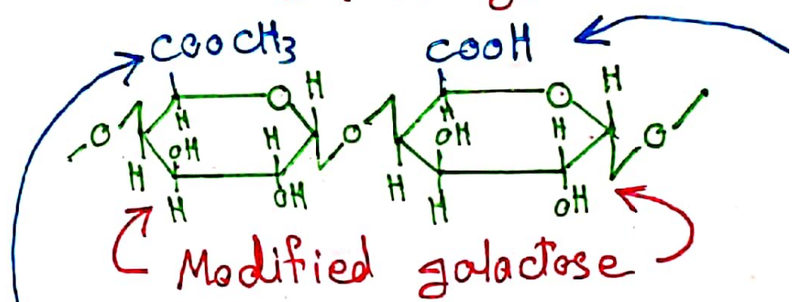
Structural

Cellulose
- Glucose connected via beta 1-4 linkage.
- They don't have branches at all.
- Glucose monomers
  - ↳ microfibers
    - ↳ macro fibrils
      - ↳ cellulose.
- Two glucose residues connected together via beta 1-4 linkage: cellobiose.
- We don't have the enzyme cellulase in our intestines.

- We use gelatin as a gelling agent but its source is animals.

Chitin
- It's present in the exoskeleton of different animals.
- It's made of repeated unit of N-acetyl glucosamine
- These monomers are connected via beta 1-4 linkage

Pectin
- Is present in plant cells and bacterial cells.
- Heteropolysaccharide
- Beta 1-4 linkage



- Is used as gelling agent.

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