

Vitamin-C

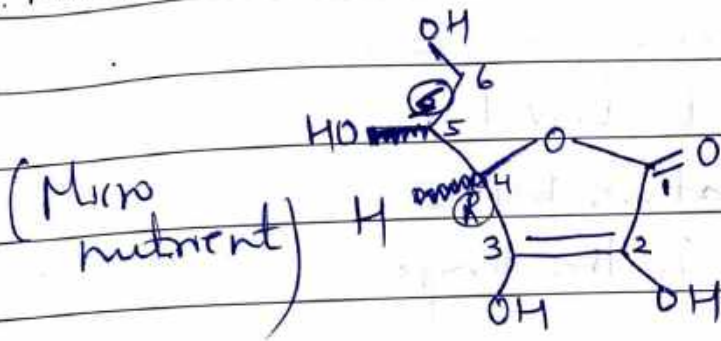
Vitamin-C or L-ascorbic acid, or simply ascorbate (anion of ascorbic acid)

'Vitamin C' always refers to the L-enantiomer of ascorbic acid, & its oxidized forms.

The opposite D-enantiomer | called D-ascorbate has equal antioxidant properties, but not found in nature.

Medicinal Value of Vitamin C ("Ascorbic Acid")

(Water Soluble)
(Antioxidant)



(White solid
(;) slight yellow
when impure)

L-ascorbic acid is known as Vitamin-C.

It is sugar acid synthesized in plants & in the livers of most vertebrates. Human being do not have the necessary enzymes for the biosynthesis of Vitamin-C, so they must obtain in their diets. It is abundant in citrus food. (Pigs, bats also don't produce Vitamin C)

Biosynthesis of Vitamin C

Ascorbic acid → Ascorbic acid is one form of Vitamin C. It was earlier called L-hexuronic acid, later when it was found to have Vitamin activity, it was renamed as, ascorbic acid

'a' → no

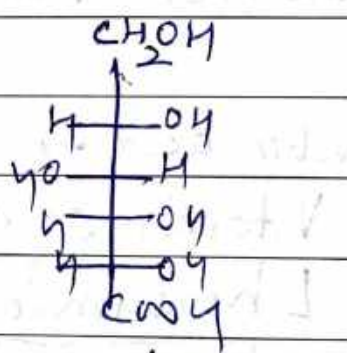
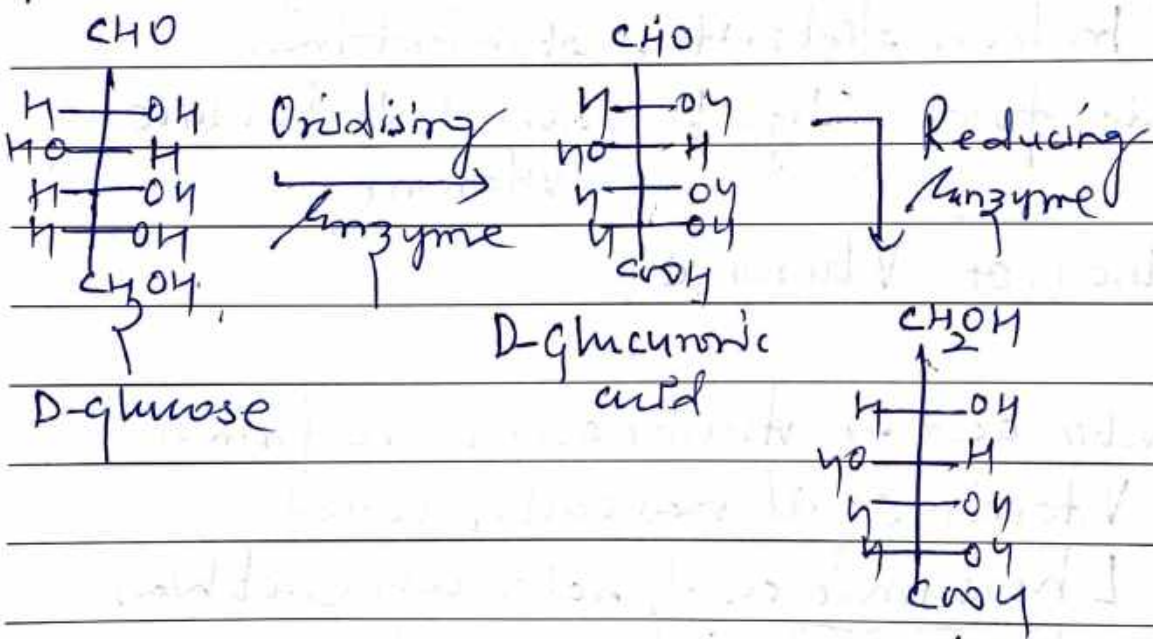
Scurbutus → Scurvy

pH

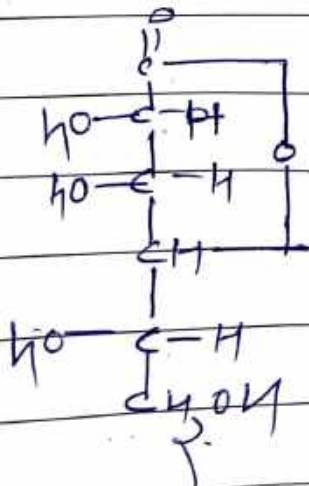
In biological systems, ascorbic acid can be found only at low pH but in neutral solns above pH 5 is predominately found in the ionized form - ascorbate

* L-configuration of ascorbic acid refers to the configuration at C-5

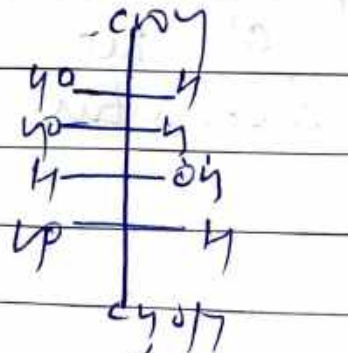
Synthesis



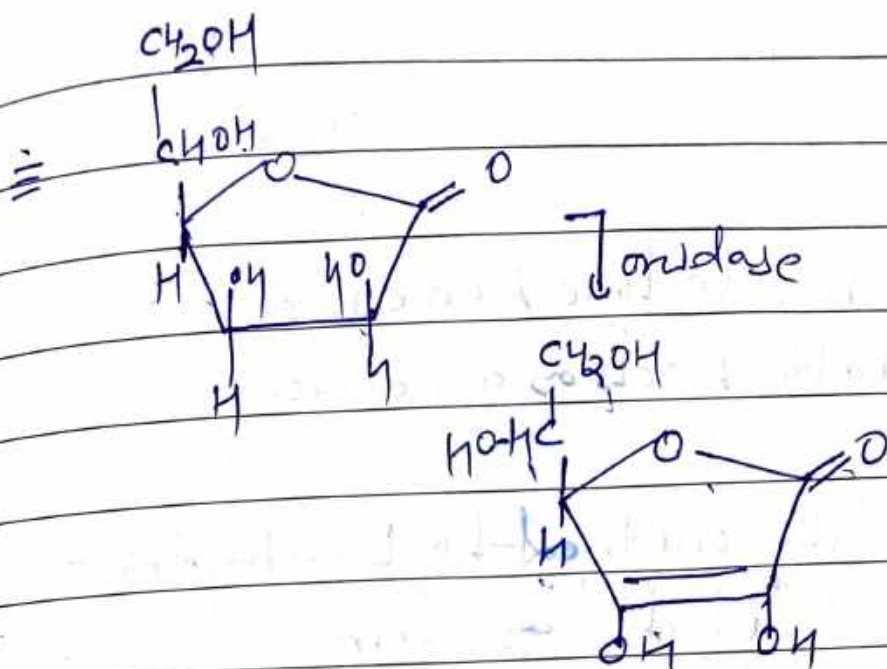
rotate 180



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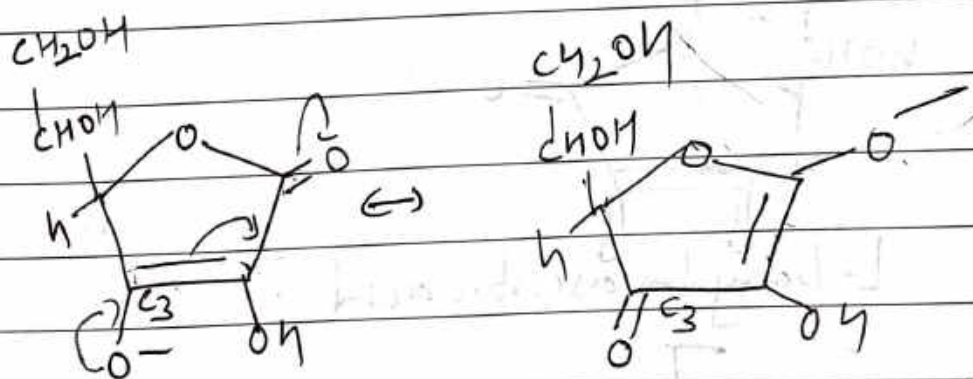
D-glucuronic acid



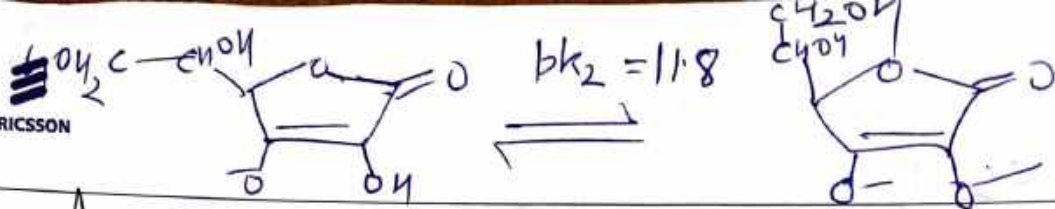
L-Ascorbic acid

Acidity of L-ascorbic acid (AsCH₂ is a Diacid)

Although L-ascorbic acid does not contain a carboxylic acid group, it is an acidic compound because the pKa of the C₃-OH gp is 4.17.



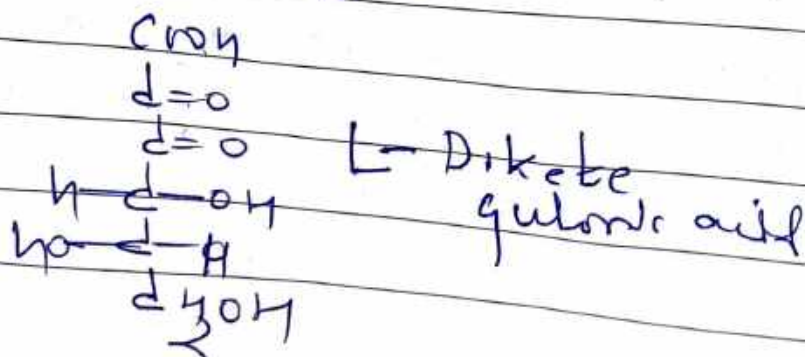
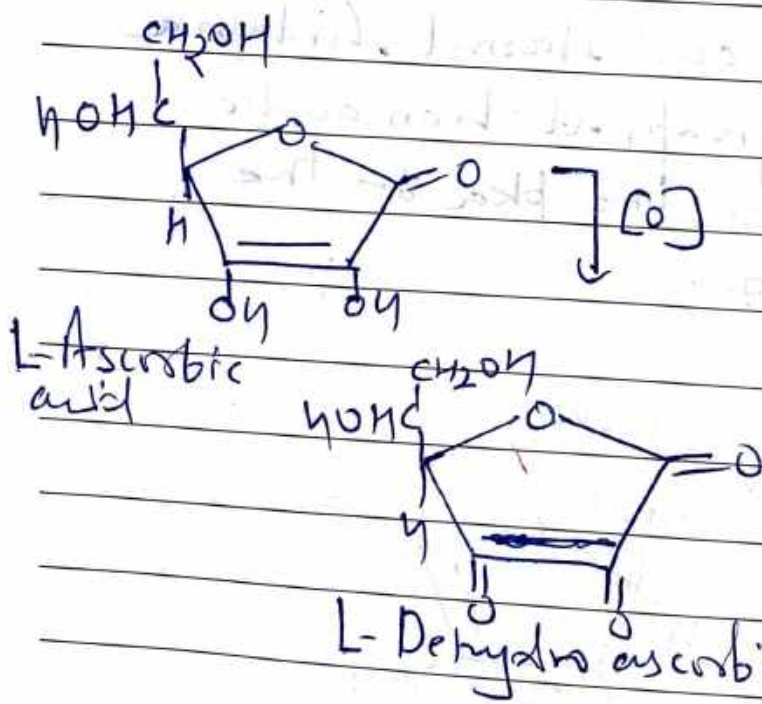
The ascorbate anion is stabilized by electron delocalization, in two canonical forms. For this reason ascorbic acid is much more acidic than would be expected if the compound contained only isolated hydroxyl groups.



Ascorbic acid as a reducing agent

Ascorbic acid is a lactone & an ene-diol. it is unstable & acts as a reducing agent.

it is readily oxidised to L-dehydroascorbic acid, which has some Vitamin-C activity, if the lactone ring is opened by hydrolysis, all Vitamin-C activity is lost.



functions

- 1) Physiological functions
 - a) Ascorbic acid performs numerous physiological functions in the human body. In human, Vitamin-C is essential to healthy diet
 - b) Effective antioxidant to lessen Oxidative stress
 - c) It also acts as an electron donor for important enzymes.

2) Synthesis of Collagen

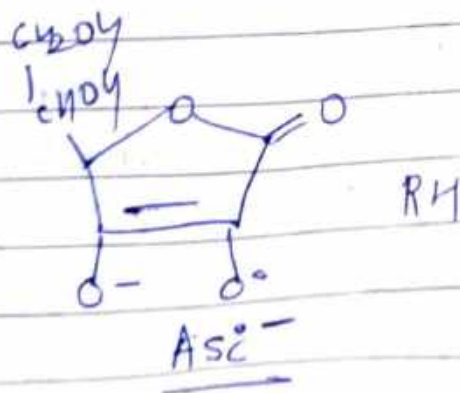
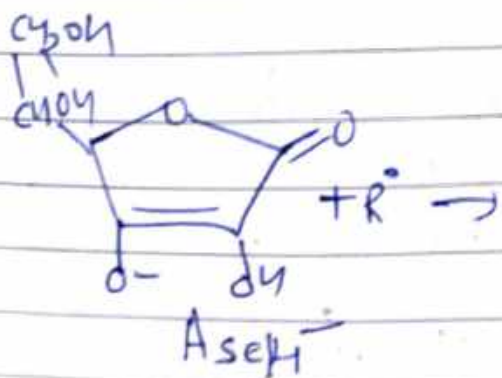
- a) Vitamin C is required for the synthesis of Collagen which is the structural protein of skin, connective tissue & bone.

The disease cause by a deficiency of Vitamin-C is Scurvy.

- b) Synthesis of neurotransmitters

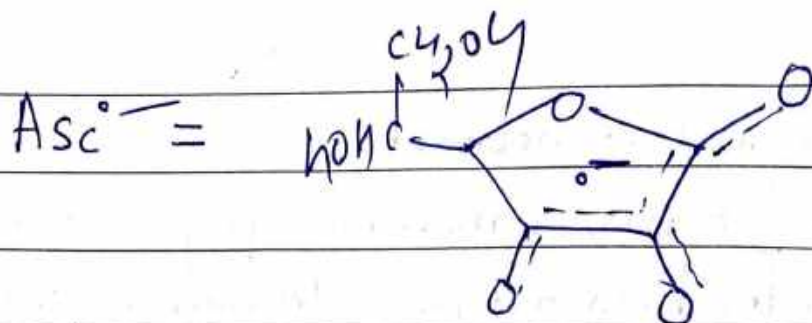
3) As antioxidant

$AsCH^-$ is a donor antioxidant



$+R^{\cdot} \rightarrow$

RH



AscH⁻ donates a hydrogen atom to an oxidizing ~~and~~ radical to produce resonance stabilized tricarbonyl ascorbate free radical.

→ When there are more free radicals in human body than antioxidants, the condition is called oxidative stress. It has impact on cardiovascular disease, hypertension, inflammatory disease, diabetes as well.

4) Ascorbic acid as e donor
Vitamin-C acts as electron donor for eight different enzymes.

a) Three enzymes participate in collagen hydroxylation (Vitamin-C as cofactor)

2) Two enzymes are necessary for synthesis of Carnitine, Carnitine is essential for the transport of fatty acid into Mitochondria for ATP generation.

5 Vitamin-C as Antihistamine

Vitamin C is a natural antihistamine & prevents histamine release

6 Therapeutic Use

- a) As antioxidant
- b) Prevents scurvy
- c) lower uric acid level.
- d) Reduces risk of ~~having~~ stroke
- e) ~~prevention & treatment of~~ common cold
- f) food additive

Linus Pauling → Worked alot on Vitamin-C Study.

→ Ascorbic acid & its Na, K & Ca salts are commonly used as antioxidant food additives for water soluble food component

→ fat soluble esters of
ascorbic acid with long chain
fatty acid can also be
used as food antioxidant