DEPTH OF BIOLOGY

# STUDY MATERIAL


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INSTA- DEPTH OF BIOLOGY

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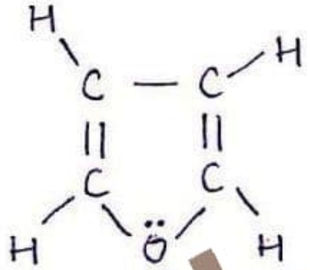
# FURAN

- It is five membered heterocyclic compounds containing oxygen (O) as a heteroatom.

OR



Chemical formula → $C_4H_4O$

Molecular wt. → 68

Other Name → Oxole

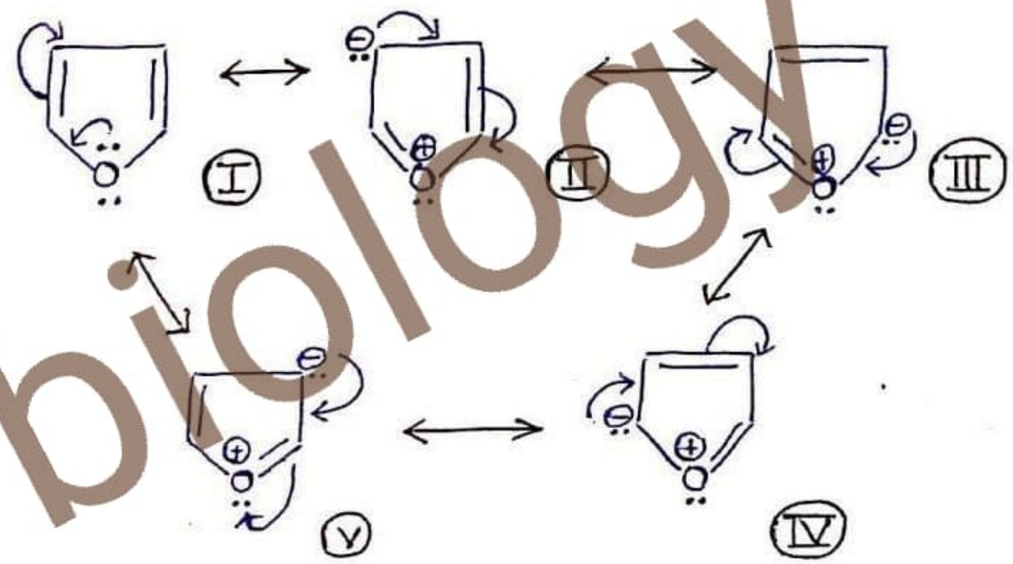
Hybridization → $sp^2$ (carbon), $sp^3$ (oxygen)

- Furan is aromatic in nature.





* Resonance :-




Physical Properties :-

- It is a colourless liquid.
- It is only slightly soluble in water.
- It has a chloroform like smell.
- Boiling point is 32°C.



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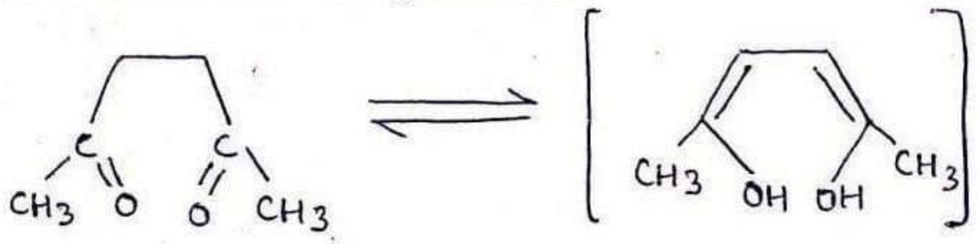
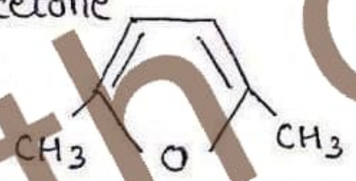
## * Synthesis (Method of Preparation)

### ① Paal Knorr Synthesis



[Hexane-2,5-dione]

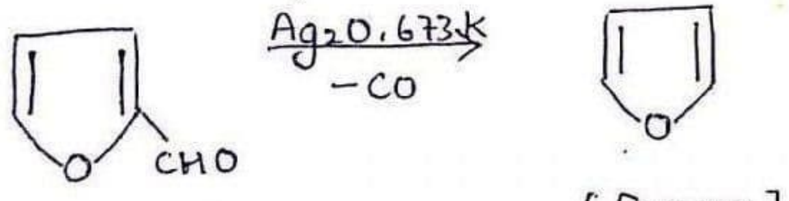
$P_2O_5, \Delta$ | $-H_2O$



[2,5-dimethyl furan]

- In this reaction, Acetonylacetone convert into an end form, which further on dehydration gives 2,5-dimethylfuran.

### ② From furfural



[Furfural]

[Furan]

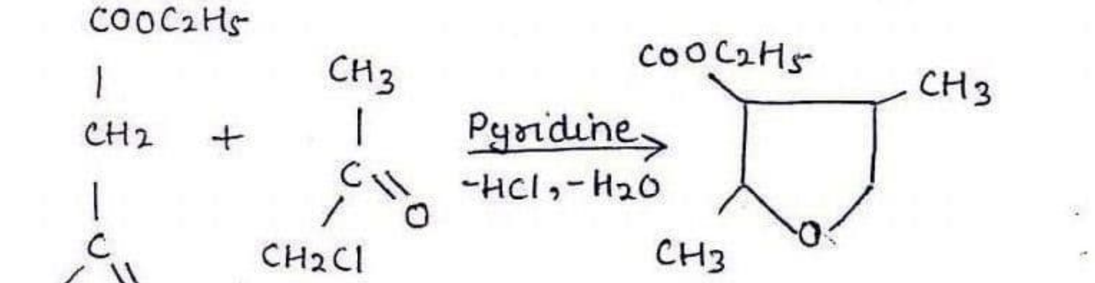




- In this reaction, furfural undergoes decarboxylation (remove 'O') by heating in steam at 673 K in the presence of silver oxide ($Ag_2O$)



### ③ Feist - Binary Synthesis

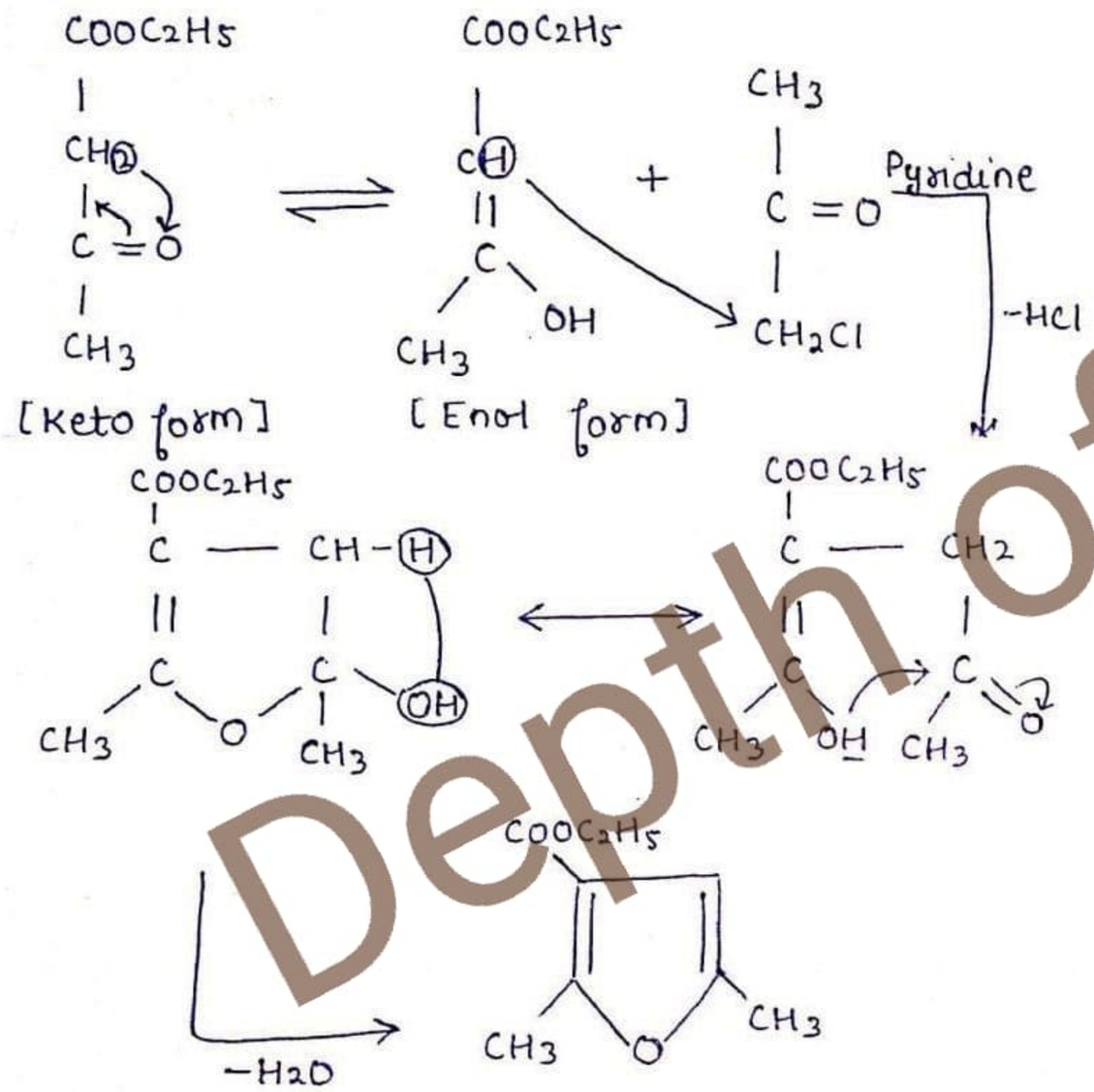


[Ethyl acetoacetate]

[Ethyl-2,5-dimethyl furan-3-carboxylat

In this reaction, β-Ketoester react with α-haloketones in the presence of pyridine to gives derivative of furan.

• Mechanism :- [DEPTH OF BIOLOGY]

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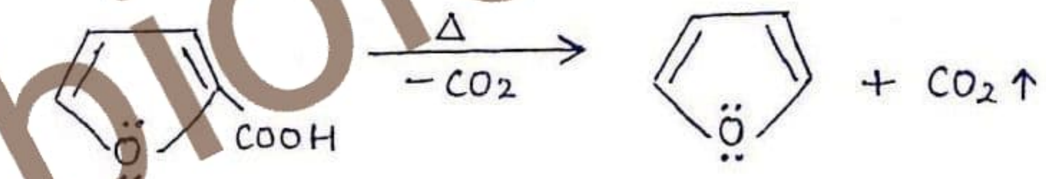
④ From furoic Acid

Decarboxylation of furoic acid yield furan.




[Furoic Acid] [Furan]

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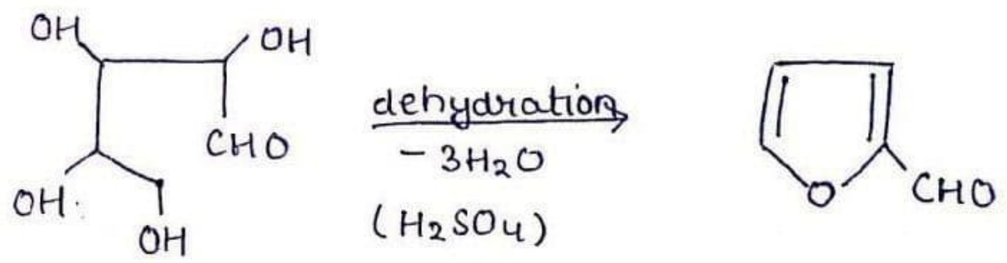
⑤ From pentose sugar




[Pentose Sugar] [Furfural]

• In this reaction, pentose sugar compound is dehydrated

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and formed forfural, which further undergoes decarboxylation and formed furan.

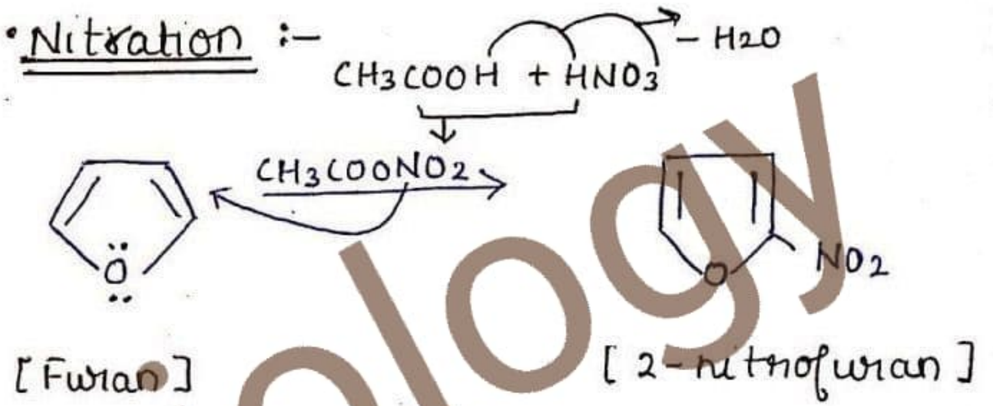
* Chemical Reaction : Furan is an aromatic compound. So it give electrophilic substitution reaction.

① Electrophillic Substitution reaction :-

In acidic condition, furan get polymerised so its reaction are carried out under mild reagent / conditions. (occur at $\alpha$ or 2 position)



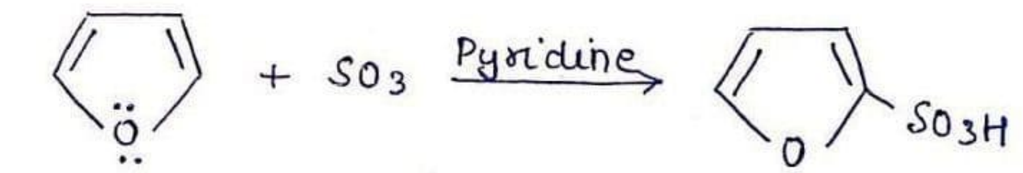
• Nitration :-




[Furan] [2-nitrofuran]

In this reaction, furan is treated with mixture of acetic anhydride and nitric acid to give 2-nitrofuran.

• Sulphonation :-




[Furan] [Furan-2-sulphonic acid]

• In this reaction, furan is treated with Pyridine - $SO_3$ complex to give 2-Furan sulphonic acid.

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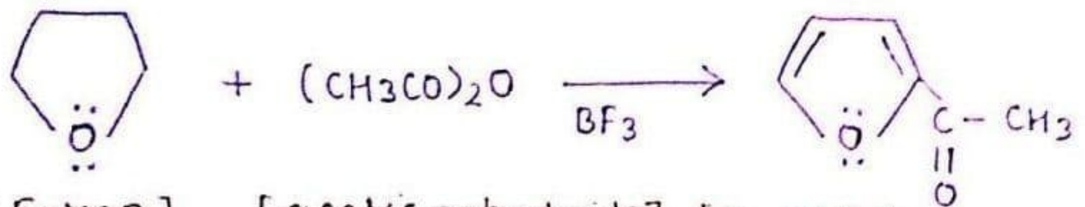
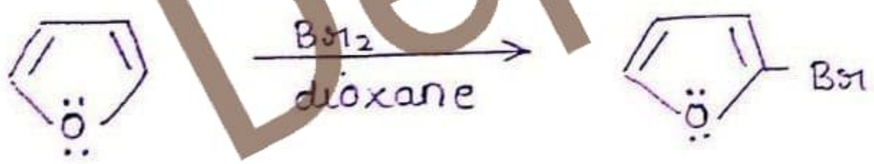
- **Friedal craft acylation** :-




[Furan] [acetic anhydride] [2-acetyl Furan]

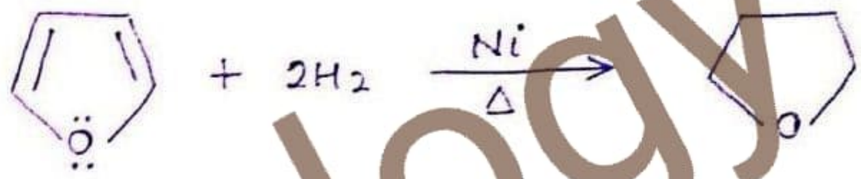
Furan on reaction with acetic anhydride in the presence of boron trifluoride gives 2-acetyl furan.

- **Bromination** :-




[Furan] [2-bromo Furan]

② **Reduction (Hydrogenation)** :-

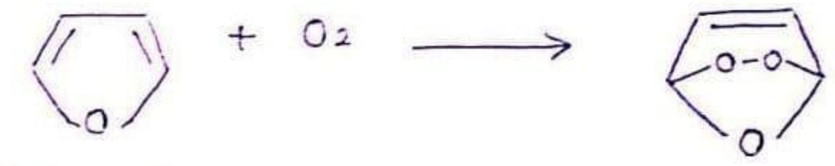



[Furan] [Tetrahydrofuran]

Furan on catalytic hydrogenation yield
↳ addition of hydrogen.

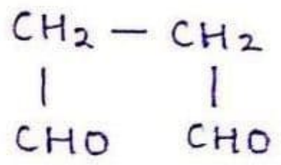
Tetrahydrofuran.

③ **Oxidation Reaction** :-




[Furan] [1,4-Peroxide]

[O]




[Succinaldehyde]

On oxidation, furan gives succinaldehyde via formation of 1,4-peroxide.



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• <u>Medicinal use of Furan and their derivatives :-</u>

• Furan and their derivatives show many pharmacological action such as antidepressant, analgesic, muscle relaxant, antihypertensive etc...

• Used as solvent for resin.

• Used in the production of agriculture chemicals stabilizer and insecticides.

• Some drugs with their use :-

① Prazosin → Used as antihypertensive

② Pilocarpin → Used in treatment of open angel glaucoma.

③ Ranitidine → inhibit stomach acid Production.

④ Lupitidine → antiulcer agent

⑤ Nitrofurazone → Used as an antibiotic.