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STUDY MATERIAL

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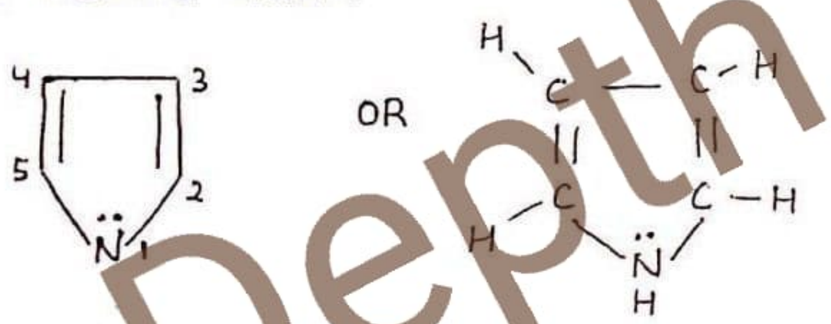
* Synthesis, reaction and medicinal uses of following compounds/derivatives :-

PYRROLE

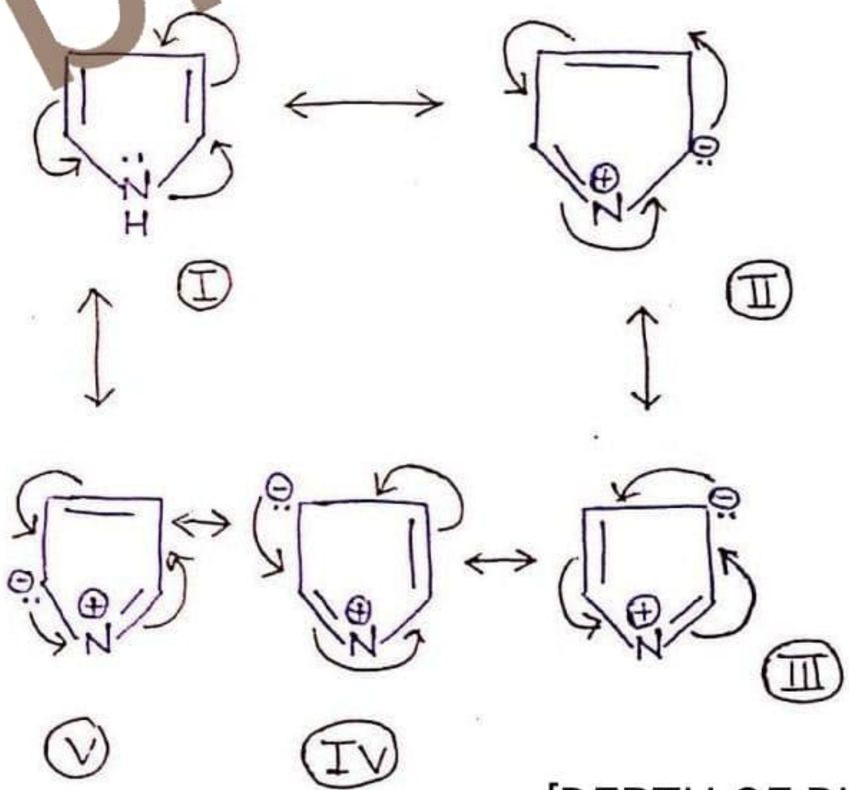
- It is 5 membered heterocyclic compound containing nitrogen 'N' as a hetero atom.



- Chemical formula → C_4H_5N
- Molecular weight → 67
- It occur naturally in alkaloids, chlorophyll, haemoglobin etc.

* Resonance

- Pyrrole is aromatic in nature.
- These are delocalisation of lone pair (present on N) and π bond.



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* Physical Properties :- [DEPTH OF BIOLOGY]

- Pyrrole is liquid which rapidly turns brown on exposure to air.
- Weakly basic in nature.
- Sparingly soluble in water but dissolve in ethanol and ether.
- Boiling point → 129°C

* Synthesis (Method of Preparation)

① From Furan → By passing the mixture of furan, ammonia and steam over the heated alumina (aluminium oxide catalyst) at 400°C.

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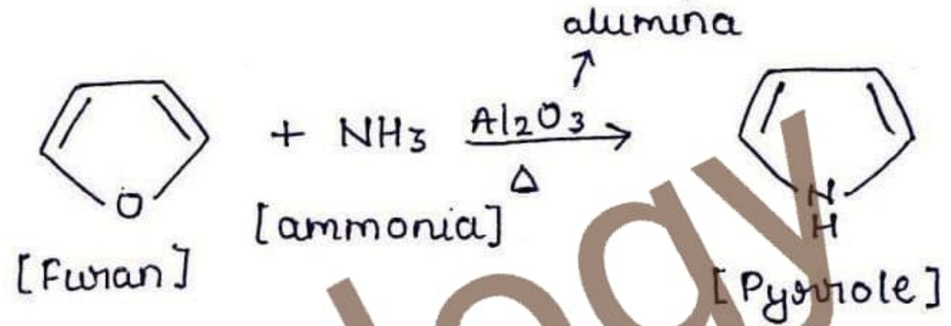
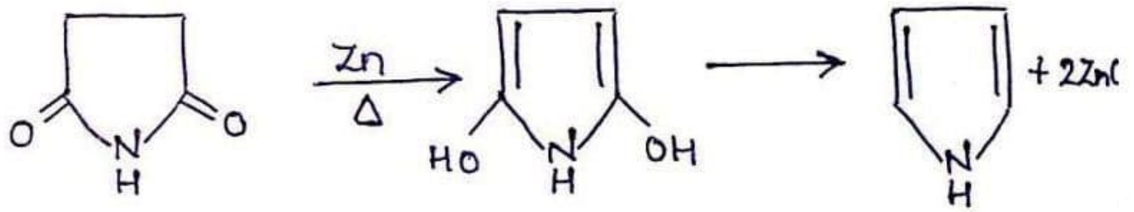


② From Succinimide → Succinimide on distillation with zinc dust give pyrrole. [DEPTH OF BIOLOGY]



[Succinimide] [Pyrrole]

③ From Acetylene → Mixture of acetylene and ammonia are passed through red-hot tube to yield pyrrole.

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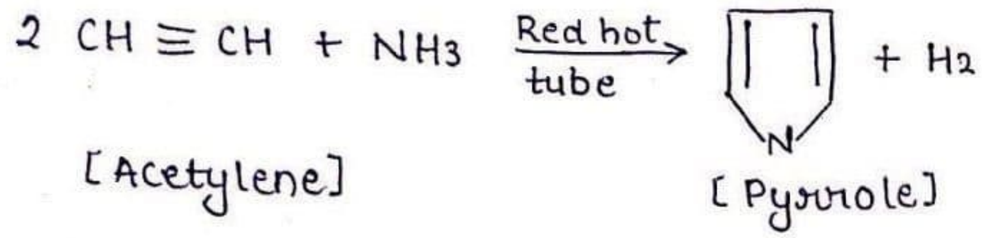
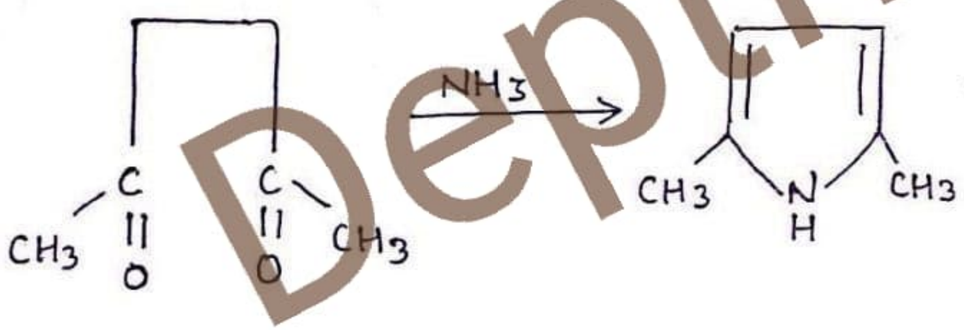


④ Paal - Knorr Synthesis (from 1,4-diketones)

In this reaction, 1,4-diketone compound react with ammonia and gives derivative of pyrrole. [DEPTH OF BIOLOGY]



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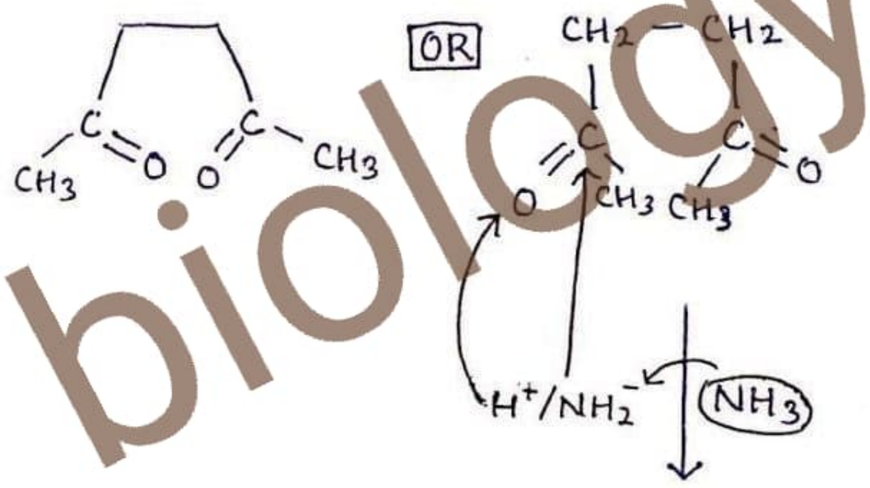
• Mechanism :-



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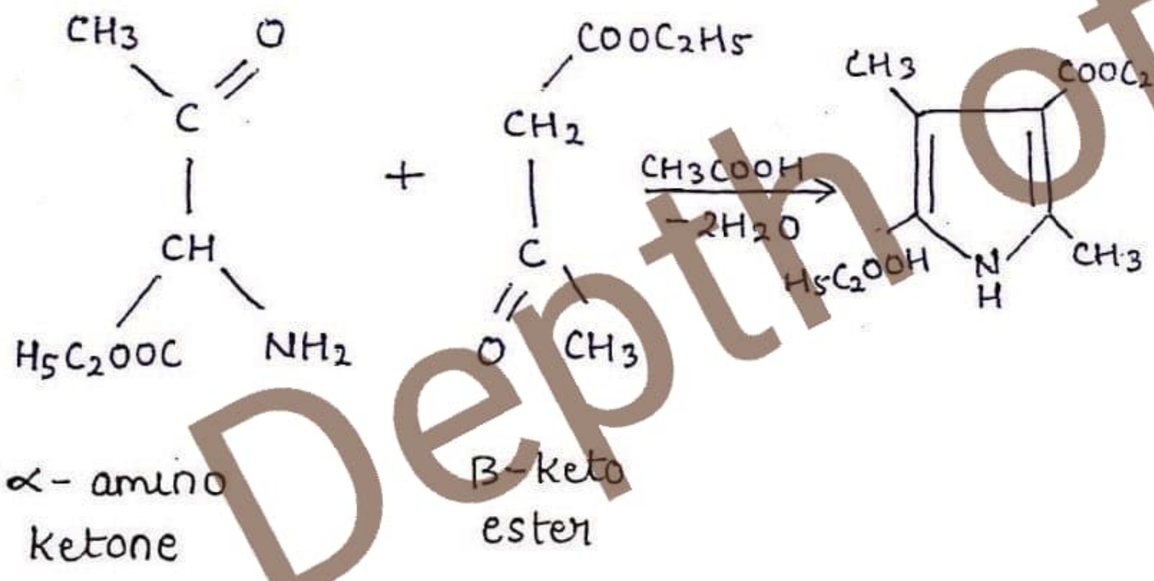
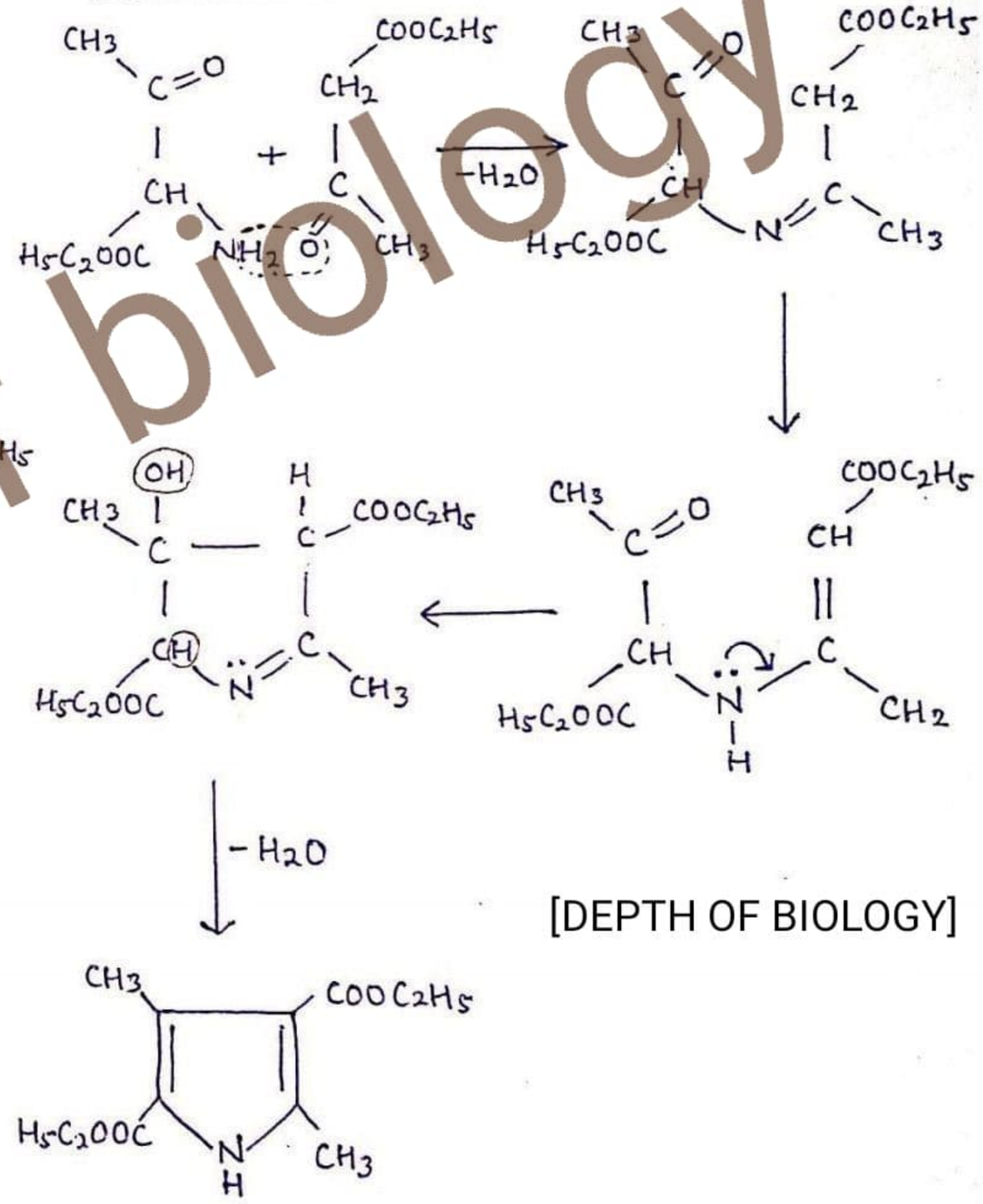
⑤ Knorr pyrrole Synthesis –:

It involve the condensation of an α-amino ketone derivatives with a β-ketoester in the presence of acetic acid.



• Mechanism :-

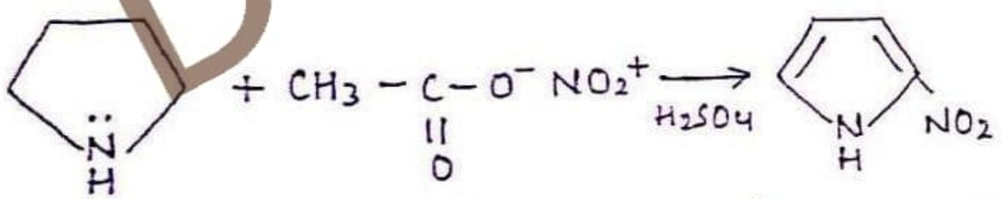


* Chemical Reaction :-

① Electrophilic Substitution reaction :-

Pyrrole has lone pair on nitrogen which have ability to donate electron so, pyrrole is more reactive than benzene and easily gives this reaction --- (occurs at α or 2nd Position)

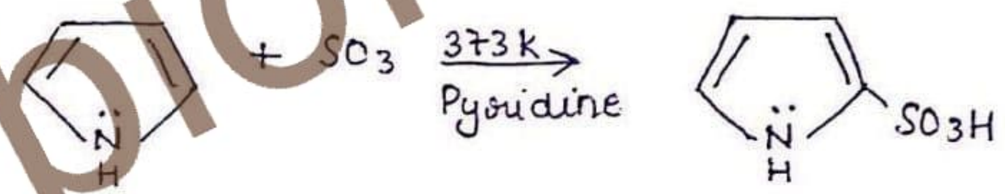
- **Nitration** → $CH_3C(=O)-OH + HNO_3$



[Pyrrole] [Acetylnitrate] [2-nitropyrrole]

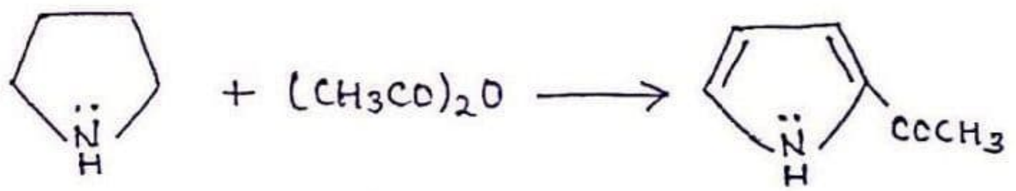
In this reaction, pyrrole is reacted with acetylnitrate in the presence of sulphonic acid to give 2-nitropyrrole.

- **Sulphonation** :-



In this reaction, pyrrole is treated with sulphuric acid in the presence of pyridine (agent) to gives pyrrole-2-sulphonic acid. [DEPTH OF BIOLOGY]

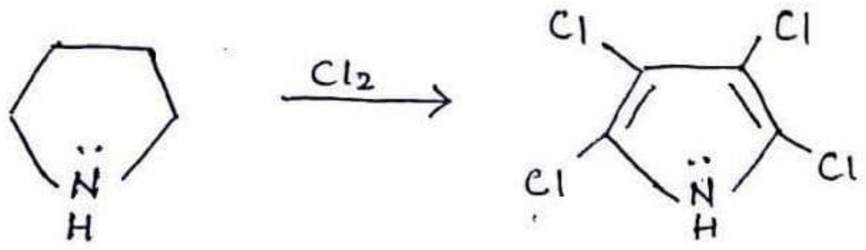
- **Friedal Craft Acylation** :-



[Pyrolle] [Acetic anhydride] [2-Acetyl pyrrole]

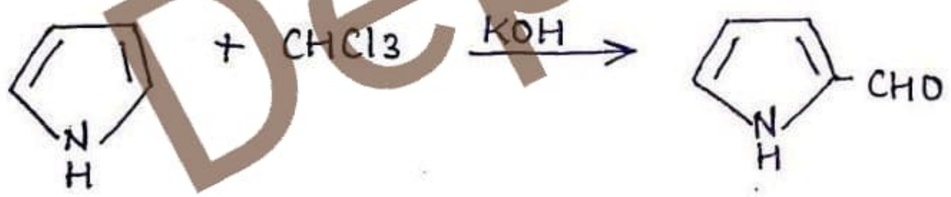
In this reaction, pyrrole is react with acetic anhydride to give 2-Acetyl pyrrole.

- Chlorination :-



[Pyrrole] [Tetrachloropyrrole]

- Riemer - Tiemann Reaction :-



[Pyrrole] [2-formyl pyrrole]

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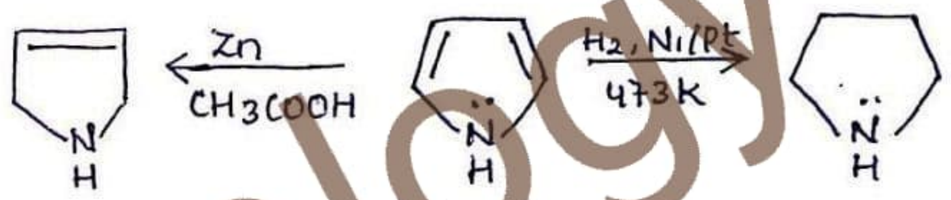
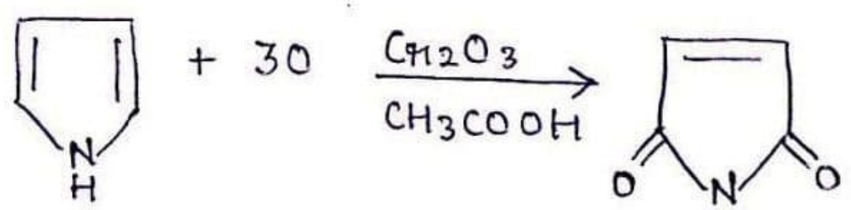
② Reduction Reaction :-



[3-pyrroline] [Pyrrole] [Pyrrolidine]

In this reaction, pyrrole react with zinc and acetic acid to give 3-pyrroline. But on react with hydrogen in presence of nickel give pyrrolidine.

(iii) Oxidation Reaction :-



[Pyrrole] [Maleinimide]

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In this reaction, Pyrrole is oxidised with chromium trioxide in the presence of acetic acid to give Maleinimide.

* <u>Medicinal use of Pyrrole and their derivatives:-</u>

• Pyrrole and its derivative are widely used as an intermediate in synthesis of Pharmaceutical medicines, agrochemicals, dyes, photographic chemicals, perfumes and other organic compounds.

• Some derivatives and their medicinal uses →

① Procyclidine → It is an anti-muscarinic drug used in the treatment of Parkinsonism.

② Atorvastatin → Useful to prevent cardiovascular disease.

③ Prodigiosin → It has antibacterial, antifungal, antimalarial and immunosuppresant activity.

④ Triprolidine → used as antihistamine.

⑤ Elopiprazole → used as antipsychotic drug.

⑥ Lincomycin, Clindomycin → used as antibiotic

⑦ Ondansetron → Used as anti-emetic.

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