

## B.Sc. III (H) PAPER-VII

### Thiophene structure and preparation

Thiophene is a heterocyclic compound having five atom ring in which four atoms are carbon and one atom is sulphur.



It is found in light oil fractions of coal tar and usually found as impurity with benzene. Thiophene can be represented

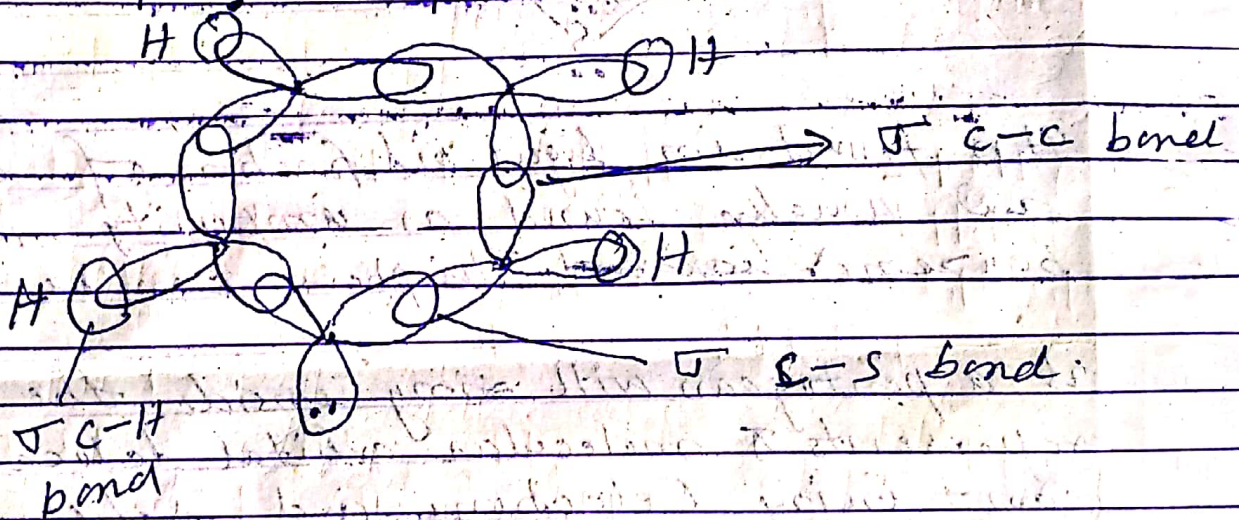
as a pentagon with a ring inside. The ring represents  $\pi$  molecular orbital delocalized containing 6 electrons and satisfy the Huckel rule of aromaticity. Hence it is aromatic compound in which all the carbon atoms and sulphur atom are  $sp^2$  hybridized. With overlapping of

$sp^2$  hybrid orbital C-C, C-S and  $\pi$  bond are formed while overlapping of  $sp^2$  hybrid orbital and s orbital of hydrogen form C-H  $\sigma$  bonds are

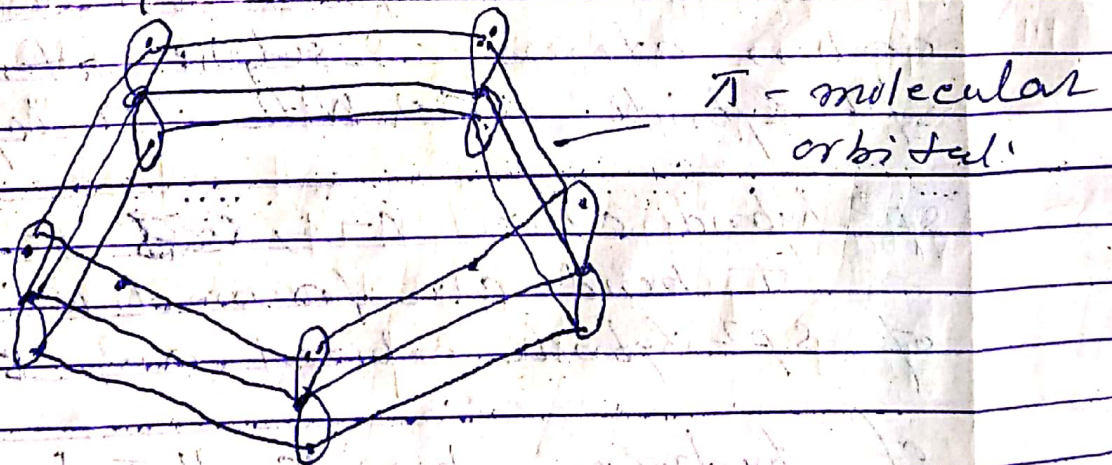
formed. Unhybrid orbital which is

perpendicular to the plane of  $sp^2$  hybrid orbitals overlaps each other to form  $\pi$  bond and all the 6 electrons are delocalised on carbon ring inside.

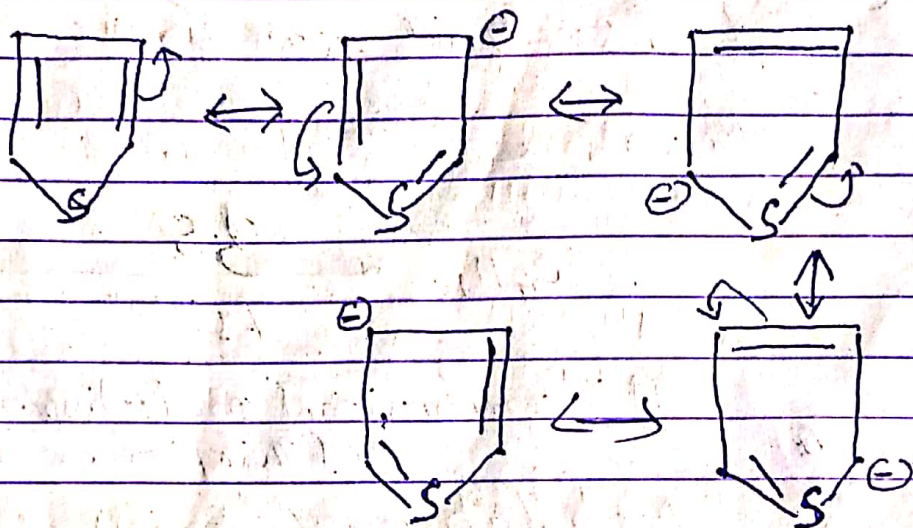
formation of  $\sigma$  bonds



Formation of  $\pi$  electron bond molecular orbital

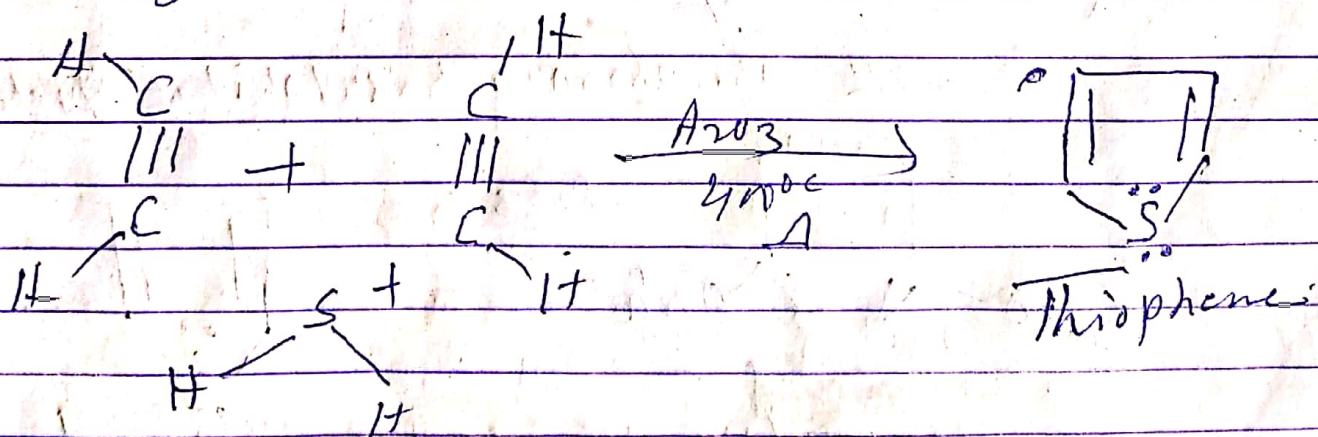


Thiophene has following five resonance structure.

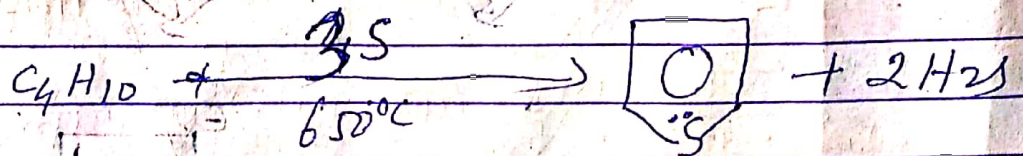


### Preparation:

(1) When mixture of acetylene and hydrogen sulphide is passed through a tube containing aluminium oxide at  $400^{\circ}\text{C}$ , thiophene is obtained.

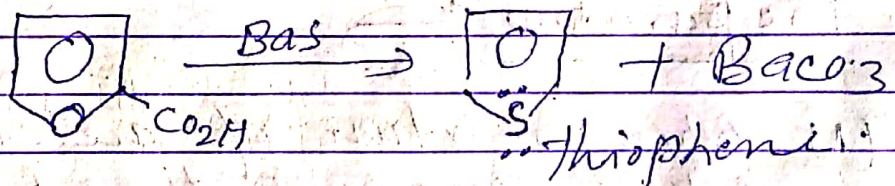


② When ~~normal~~ normal butane is heated at:  $650^{\circ} - 700^{\circ}\text{C}$  in presence of sulphur thiophene is obtained.



It is commercial production of thiophene

③ Distillation of furoic acid with Bas yields thiophene



④ Warming sodium succinate solution with phosphorous trisulphide yields Thiophene

