



Pharma D Program / First Year Block III
General Basic sciences



Heterocyclic Compounds

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Intended learning outcomes

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By the end of this session you will be able to:

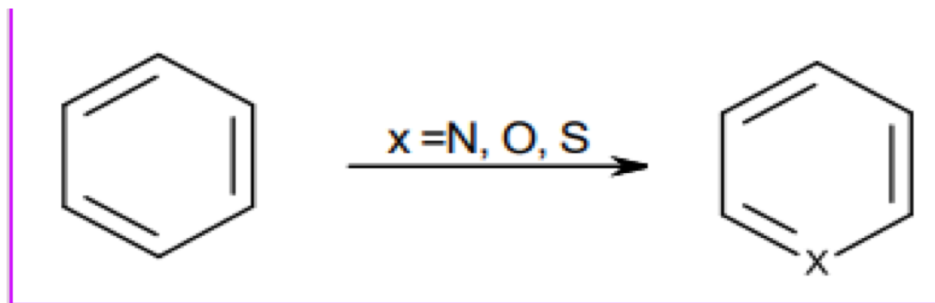
- Define a heterocyclic compound
- Classify heterocyclic compounds
- Identify the five membered heterocyclic compounds (pyrrole, furan , thiophene)
- Mention the importance of heterocyclic compounds

Heterocyclic Compounds

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What's a heterocyclic compound?

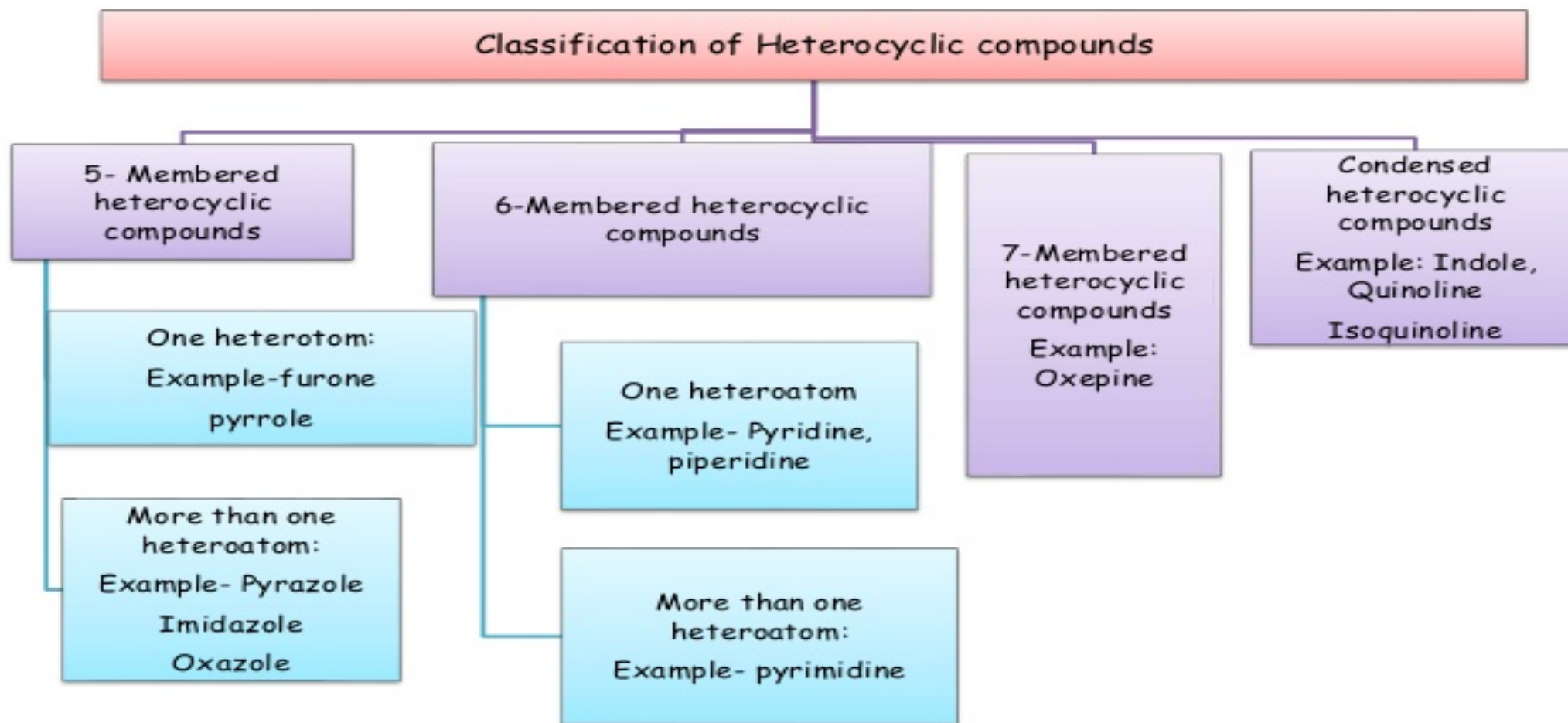
If the ring system is made up of carbon atoms and at least one other element, the compound can be classified as heterocyclic (that is, hetero atoms). As hetero atom can be N, O, S, B, Al, Si, P, Sn, As, , Cu. But The elements that are found most commonly together with carbon in a ring system are Nitrogen (N), Oxygen(O), and Sulfur(S).



Significance – Two thirds of all organic compounds are aromatic heterocycles. Most pharmaceuticals are heterocycles.

Classification of heterocyclic compounds

4



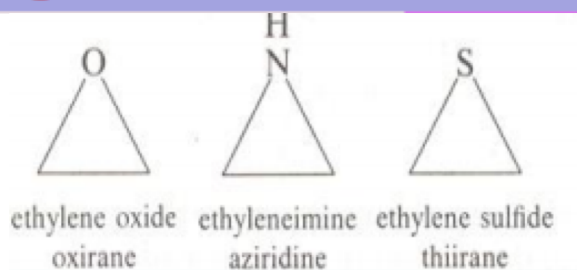
HETEROCYCLIC

Classification

1- Classification according to number of ring components :-

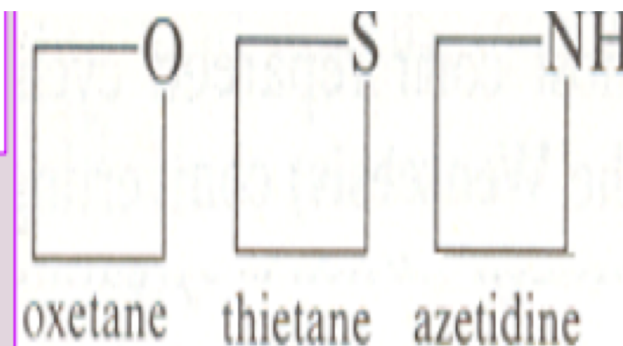
a. Monocyclic: One ring structure

1) Three membered hetrocycles

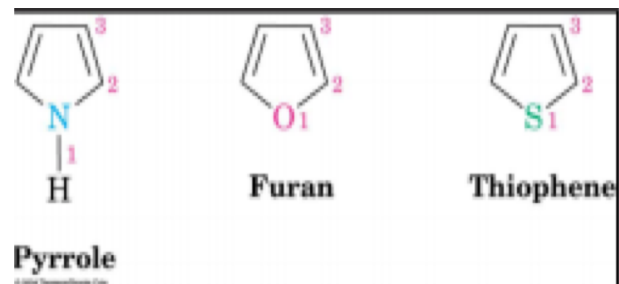


2) Four membered hetrocycles

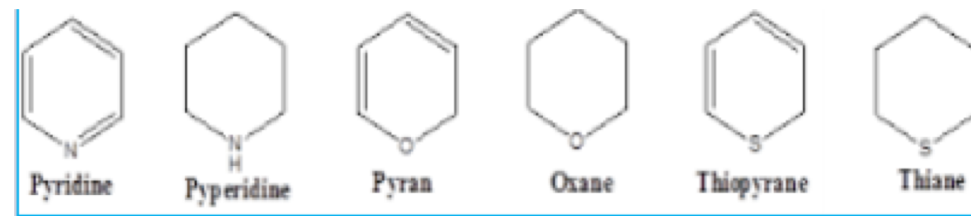
rarer, because of the greater difficulty of preparing 4 member



3) five-membered hetrocycles



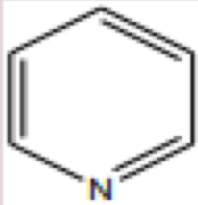
4) six-membered hetrocycles



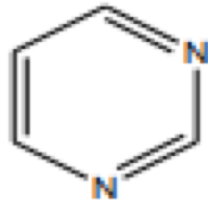
HETEROCYCLIC

Classification

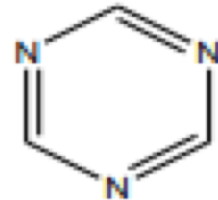
2. Classification according to number of heteroatoms in a ring



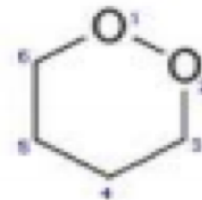
pyridine



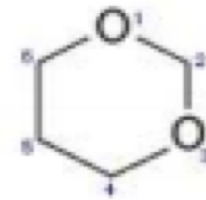
pyrimidine



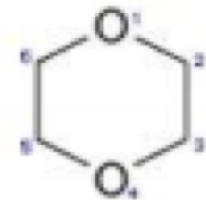
1,3,5-triazine



1,2-dioxane



1,3-dioxane



1,4-dioxane

3. Classification according to position of heteroatoms to each other



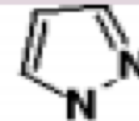
Oxazole
(1,3-oxazole)



Isoxazole
(1,2-oxazole)



Imidazole
(1,3-diazole)



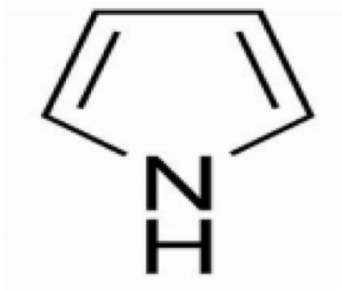
Pyrazole
(1,2-diazole)

The five membered heterocyclic compounds (pyrrole, furan , thiophene)

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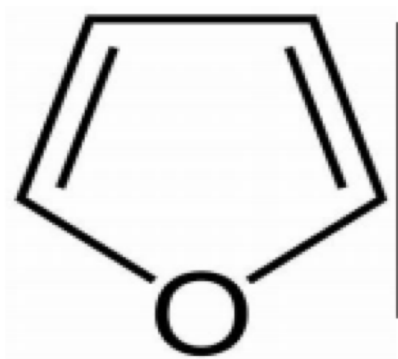
Pyrrole

Pyrrole is a nitrogen-containing unsaturated five-membered heterocyclic aromatic compound. It shows aromaticity by delocalization of a lone pair of electrons from nitrogen.



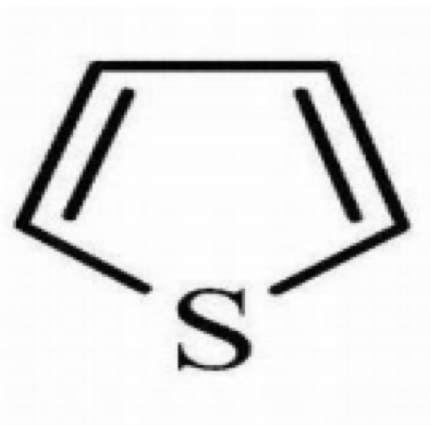
Furan

Furan, is an oxygen-containing five-membered aromatic heterocyclic compound. The highly electronegative oxygen holds on the electron density tightly. Although it has a lone pair of electrons, these electrons cannot delocalize easily, and so the system is generally considered to be almost non-aromatic or weakly aromatic.



Thiophene

Thiophene is a Sulphur-containing five-membered unsaturated heterocyclic. Thiophene is considered weakly aromatic. The thiophene ring is present in many important pharmaceutical products.



Importance of heterocyclic compounds

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Heterocyclic compounds include many of the biochemical material essential to life. For example, nucleic acids, the chemical substances that carry the genetic information controlling inheritance, consist of long chains of heterocyclic units held together by other types of materials. Many naturally occurring pigments, vitamins, and antibiotics are heterocyclic compounds, as are most hallucinogens. Modern society is dependent on synthetic heterocyclic for use as drugs, pesticides, dyes, and plastics.

