HETEROCYCLIC COMPOUNDS

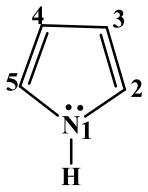
A cyclic compound (ring compound) is a term for compound in the field of Chemistry in which one or more series of atoms in the compound is connected to form a ring.

Cyclic compounds have a ring structure hence called cyclic. If carbon is present in the ring, it is called homocyclic compound, But if one or more of the carbon atoms is replaced by any heteroatoms as S, N, O etc. are called heterocyclic compounds.

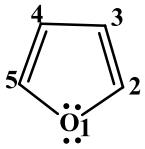
Note- Another heteroatoms such as B, P or Si also form heterocyclic compounds.

Homo= same

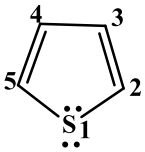
Hetero= different



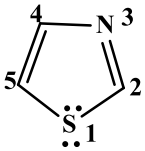
Pyrrole
(Azole)



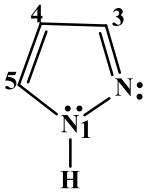
Furan
(Oxole)



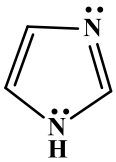
Thiophene
(Thiole)



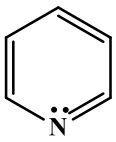
1,3- Thiazole
(Thiazole)



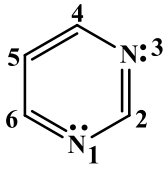
Pyrazole (1,2-diazole)



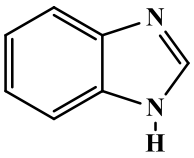
Imidazole (1,3-diazole)



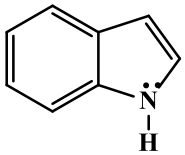
Pyridine



Pyrimidine
(1,3-diazine)



Benzimidazole



Indole

Classification:

Depending upon their structures, heterocyclic compounds may be of three types:

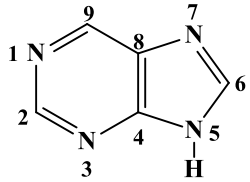
A. Five-membered heterocyclics :
Compounds with five-membered ring and one or more heteroatoms in them are referred to as five membered heterocyclic compounds.
Eg.- Pyrrole, Furan, Thiophene, Thiazole, Imidazole, Pyrazole.

B. Six- membered heterocyclics :
Compounds with six-membered ring and one or more heteroatoms in them are referred to as six membered heterocyclic compounds.

Eg.- Pyridine and Pyrimidine.

C. Condensed (fused) heterocyclics :

They consist of two or more rings fused together. The fused rings may be partly carbocylic or partly heterocyclic (Indole, Benzimidazole) or completely heterocyclic (Purine).

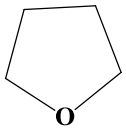


Purine (Pyridine + Imidazole)

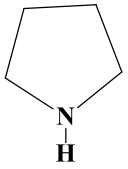
Depending on their properties, heterocyclics may be of two types:

A. Heteroparaffins or non-aromatic heterocyclics:

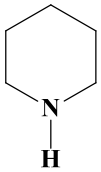
They resemble paraffins in their properties and are not aromatic in nature.



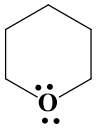
THF
(Tetrahydrofuran)



Pyrrolidine



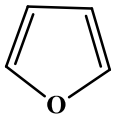
Piperidine



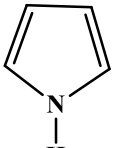
Tetrahydropyran

B. Heterocyclics or aromatic heterocyclics:

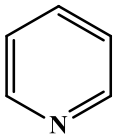
They resemble aromatic compounds in their properties and aromatic in nature.



Furan



Pyrrole



Pyridine

Nomenclature:

1. The systematic names for monocyclic compounds are given by using prefix for the nature of heteroatom present and dropping ‘a’ whenever necessary.
   Eg.- Oxa (for Oxygen), thia (Sulphur), aza (nitrogen) etc. If two or more similar heteroatoms are present, the prefix di, tri etc. are used.
   Eg.- Triaza, Trioxa etc. If heteroatoms are different, the order starts from heteroatom of the highest group in the Periodic table and as low as an atomic number, when in same group. Eg.- O, S, N, P (O then N).
2. The size of the monoheterocyclics is indicated by suffix- ole (5-membered), -ine (6-membered) etc.

3. If monoheterocyclic numbering is given in such a way that heteroatom gets the lowest number and it proceeds anticlockwise around the ring.
4. When heteroatoms are different, the numbering starts according to point no.-1 and proceeds round the ring in order of precedence or priority.