

**B.Sc. Semester-IV
Core Course-IX (CC-IX)
Organic Chemistry-III**



III. Heterocyclic Compounds

19. IUPAC Nomenclature in Heterocyclic Compounds : Hantzsch-Widman Method-II



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Heterocyclic Compounds

3-membered (Common heteroatoms)

Those with one heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen	Aziridine	Azirine
Oxygen	Oxirane (ethylene oxide, epoxides)	Oxirene
Sulfur	Thiirane	Thiirene

Those with two heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen	-----	Diazirine
Nitrogen/oxygen	Oxaziridine	-----
Oxygen	Dioxirane	-----

4-membered rings (Common heteroatoms)

Those with one heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen	Azetidine	Azete
Oxygen	Oxetane	Oxete
Sulfur	Thietane	Thiete

Those with two heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen	Diazetidine	-----
Oxygen	Dioxetane	Dioxete
Sulfur	Dithietane	Dithiete

Heterocyclic Compounds

5-membered rings (Common heteroatoms)

Those with one heteroatoms		
Heteroatom	Saturated	Unsaturated
Nitrogen	Pyrrolidine (Azolidine is not used)	Pyrrole (Azole is not used)
Oxygen	Tetrahydrofuran (Oxolane is rare)	Furan (Oxole is not used)
Sulfur	Thiolane	Thiophene (Thiole is not used)

Those with three heteroatoms

Heteroatom	S	Unsaturated
3 × Nitrogen		Triazoles
2 × Nitrogen / 1 × oxygen		Furazan Oxadiazole
2 × Nitrogen / 1 × sulfur		Thiadiazole
1 × Nitrogen / 2 × sulfur		Dithiazole

Heterocyclic Compounds

Those with two heteroatoms		
Heteroatom	Saturated	Unsaturated (and partially unsaturated)
Nitrogen / nitrogen	Imidazolidine Pyrazolidine	Imidazole (Imidazoline) Pyrazole (Pyrazoline)
Nitrogen / oxygen	Oxazolidine Isoxazolidine	Oxazole (Oxazoline) Isoxazole
Nitrogen / sulfur	Thiazolidine Isothiazolidine	Thiazole (Thiazoline) Isothiazole
Oxygen / oxygen	Dioxolane	
Sulfur / sulfur	Dithiolane	

Heterocyclic Compounds

6-membered rings (Common heteroatoms)

Those with one heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen	Piperidine (Azinane is not used)	Pyridine (Azine is not used)
Oxygen	Oxane	Pyran (2H-Oxine is not used)
Sulfur	Thiane	Thiopyran (2H-Thiine is not used)

Those with two heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen/nitrogen	Piperazine	Diazines
Oxygen / nitrogen	Morpholine	Oxazine
Sulfur / nitrogen	Thiomorpholine	Thiazine
Oxygen / oxygen	Dioxane	Dioxine
Sulfur / sulfur	Dithiane	Dithiine

Those with three heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen		Triazine
Oxygen	Trioxane	
Sulfur	Trithiane	

Those with four heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen		Tetrazine

Heterocyclic Compounds

7-membered rings (Common heteroatoms)







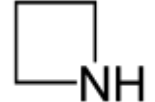

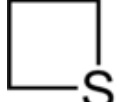



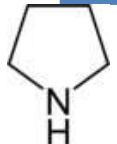

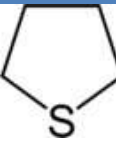
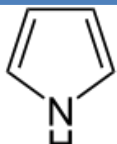
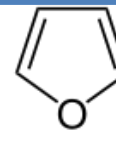
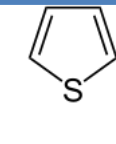
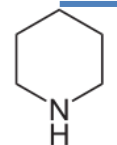
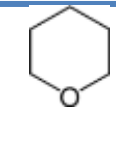
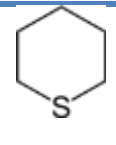
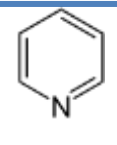
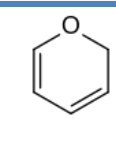
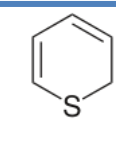
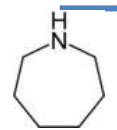
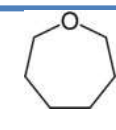
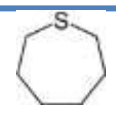
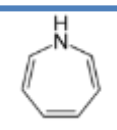
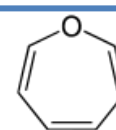
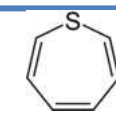
Those with one heteroatoms

Heteroatom	Saturated	Unsaturated
Nitrogen	Azepane	Azepine
Oxygen	Oxepane	Oxepine
Sulfur	Thiepane	Thiepine

Those with two heteroatoms

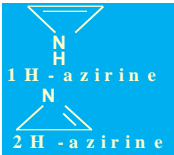



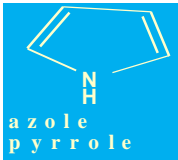
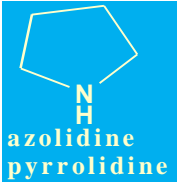
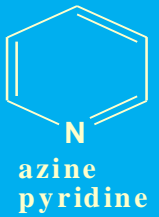
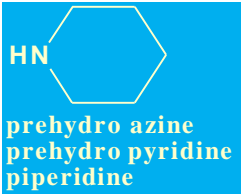
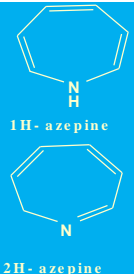

Heteroatom	Saturated	Unsaturated
Nitrogen	Homopiperazine	Diazepine
Nitrogen/sulfur		Thiazepine

Heterocyclic Compounds







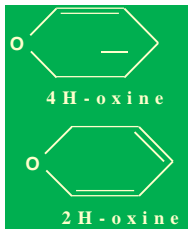

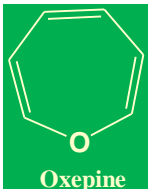
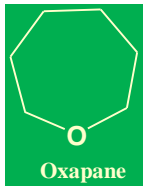
Heteroatom	<u>Nitrogen</u>	<u>Oxygen</u>	<u>Sulfur</u>	Nitrogen	Oxygen	Sulfur
3-Atom Ring	<u>Aziridine</u> 	<u>Oxirane</u> 	<u>Thiirane</u> 	<u>Azirine</u> 	<u>Oxirene</u> 	<u>Thiirene</u> 
4-Atom Ring	<u>Azetidine</u> 	<u>Oxetane</u> 	<u>Thietane</u> 	<u>Azete</u> 	<u>Oxete</u> 	<u>Thiete</u> 
5-Atom Ring	<u>Pyrrolidine</u> 	<u>Oxolane</u> 	<u>Thiolane</u> 	<u>Pyrrole</u> 	<u>Furan</u> 	<u>Thiophene</u> 
6-Atom Ring	<u>Piperidine</u> 	<u>Oxane</u> 	<u>Thiane</u> 	<u>Pyridine</u> 	<u>Pyran</u> 	<u>Thiopyran</u> 
7-Atom Ring	<u>Azepane</u> 	<u>Oxepane</u> 	<u>Thiepane</u> 	<u>Azepine</u> 	<u>Oxepine</u> 	<u>Thiepine</u> 

Heterocyclic Compounds

Ring containing N

Ring size	Unsaturation	Saturation	Unsaturation	Saturation
3	irine	iridine	 <p>1H-azirine 2H-azirine</p>	 <p>Aziridine</p>
4	ete	etidine	 <p>Azete</p>	 <p>Azetidine</p>
5	ole	olidine	 <p>azole pyrrole</p>	 <p>azolidine pyrrolidine</p>
6	ine	prehydro	 <p>azine pyridine</p>	 <p>prehydro azine prehydro pyridine piperidine</p>
7	epine	prehydro	 <p>1H-azepine 2H-azepine</p>	 <p>Prehydro azepine</p>

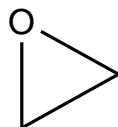
Ring without N

Unsaturation	Saturation	Unsaturation	Saturation
irene	irane	 <p>Oxirene</p>	 <p>Oxirane</p>
ete	etane	 <p>Oxete</p>	 <p>Oxetane</p>
ole	olane	 <p>oxole furan</p>	 <p>oxolane THF</p>
ine	ane	 <p>4H-oxine 2H-oxine</p>	 <p>Oxane</p>
epine	epane	 <p>Oxepine</p>	 <p>Oxapane</p>

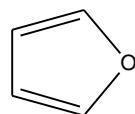
Heterocyclic Compounds

✓ **Hantzsch – Widman Nomenclature** (adopted by IUPAC)

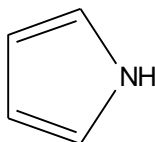
Ring Size	Saturated	Partly Saturated	Unsaturated
3	-irane	-	-irene
4	-etane	(dihydro)	-ete
5	-olane	(dihydro)	-ole
6	-inane	(di or tetrahydro)	-ine
7	-epane	(di or tetrahydro)	-epine
8	-ocane	(di, tetra, or hexahydro)	-ocine



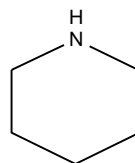
Common name : ethylene oxide
Systematic name : Oxa + irane ...Oxirane



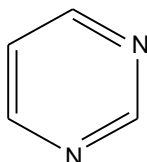
Common name : furan
Systematic name : Oxa + ole Oxole



Common name : pyrrole
Systematic name : H at 1 position + Aza + ole 1H-Azole



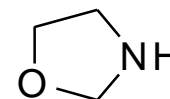
Common name : piperidine
Systematic name : Aza + inane 1H-Azinane



Common name : pyrimidine
Systematic name : two aza at 1, 3 positions + ine [1,3]-diazine



thiacyclobutane



1-oxa-3-azacyclopentane

Thank You



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