Date:
3 /12 / 2023

لجان الدُّفعات

Soul Academy

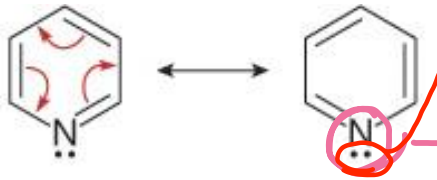
تفريغ عضويه 1

موضوع المحاضرة: Chapter (15)

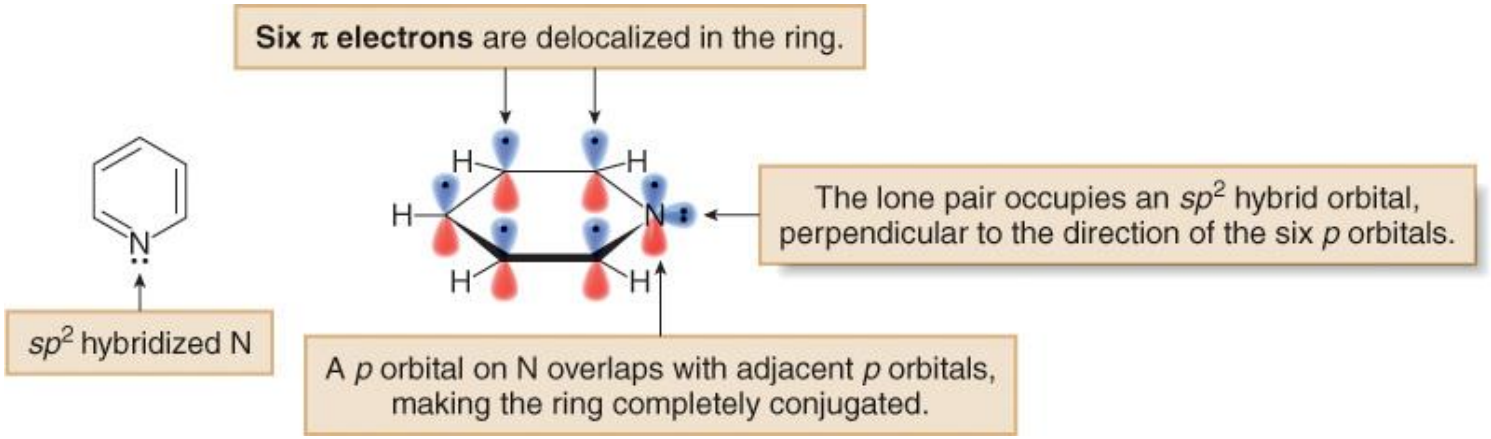
رقم المحاضرة: محاضرة (8)

إعداد الصيدلانيه: Gufran Khaseeb

Aromatic Heterocycles



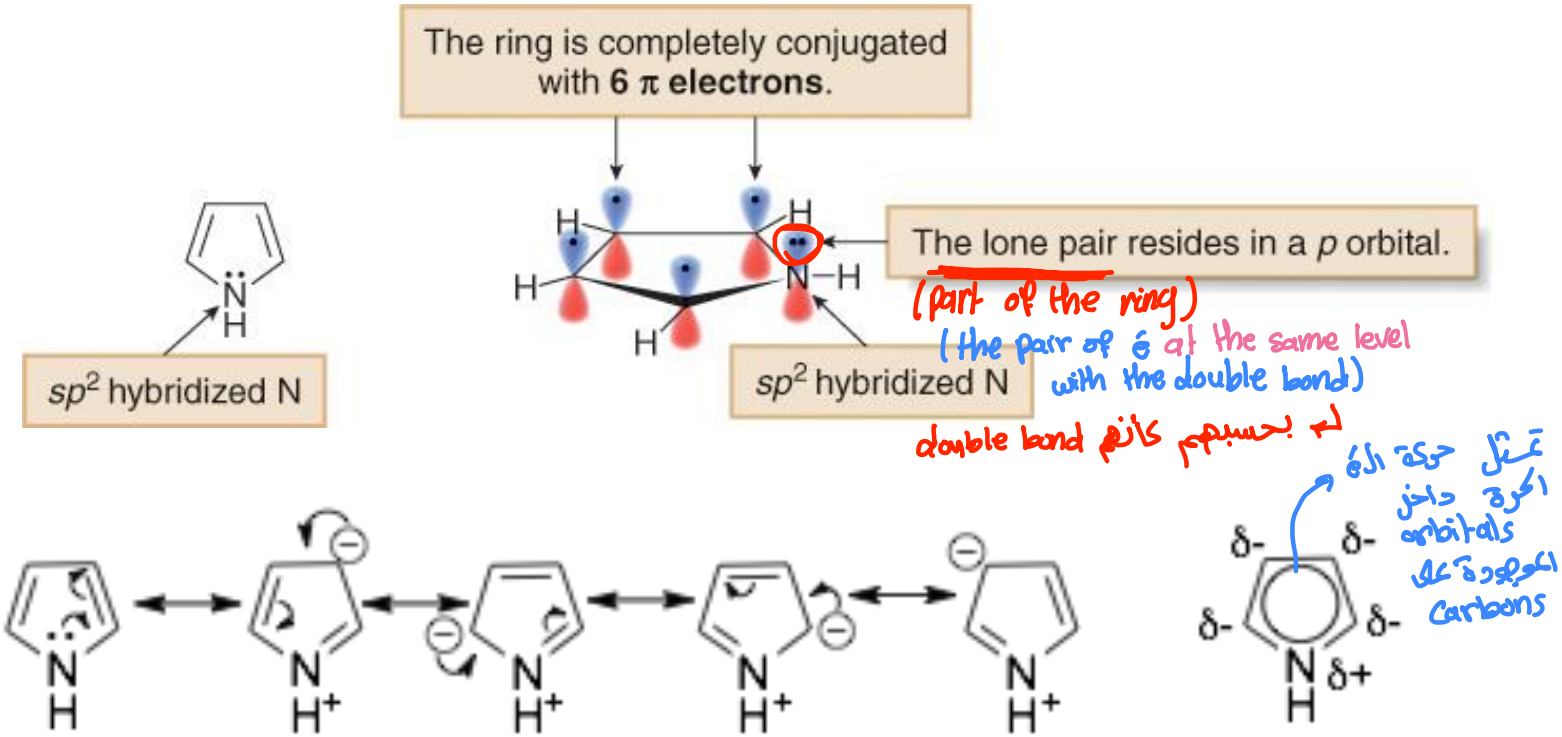
two resonance structures for pyridine
6 π electrons



2H-pyran
4 π electrons
nonaromatic

2H-pyrilium ion
6 π electrons
aromatic

Aromatic Heterocycles

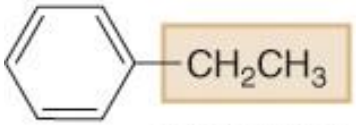


furan

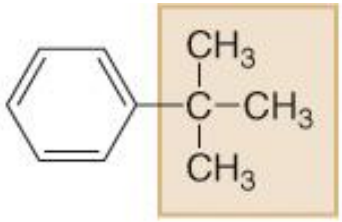
thiophen

Nomenclature: 1 Substituent

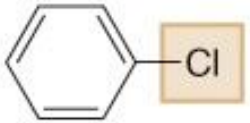
Systematic:



ethyl group



tert-butyl group



chloro group

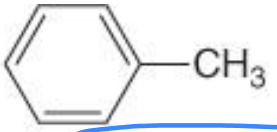
ethylbenzene

common name

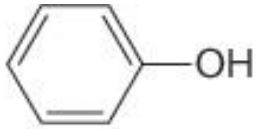
tert-butylbenzene

chlorobenzene

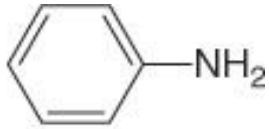
Common:



toluene
(methylbenzene)



phenol
(hydroxybenzene)



aniline
(aminobenzene)

Nomenclature: 2 Substituents

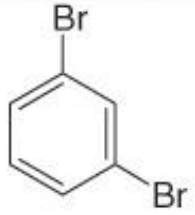
لازم نحدد مكانهم

Identical:

1,2-disubstituted benzene **ortho** isomer

1,2-dibromobenzene
o-dibromobenzene

1,3-disubstituted benzene **meta** isomer



1,3-dibromobenzene
m-dibromobenzene

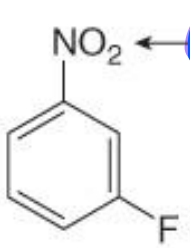
1,4-disubstituted benzene **para** isomer

1,4-dibromobenzene
p-dibromobenzene

Different:

Alphabetize two different substituent names:

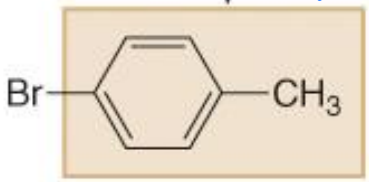
ortho
o-bromochloro-benzene



meta
m-fluoronitro-benzene

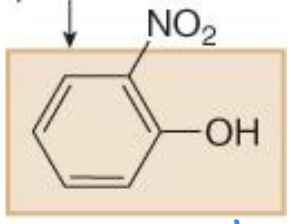
Use a common root name:

toluene → common name



para
p-bromotoluene

phenol



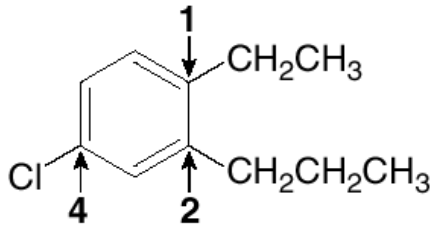
o-nitrophenol

when the OH at benzen ring

Nomenclature: 3 or More Substituents

Examples of naming polysubstituted benzenes

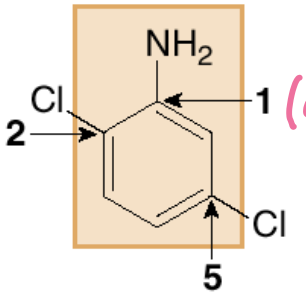
[1]



- Assign the lowest set of numbers.
- Alphabetize the names of all the substituents.

4-chloro-1-ethyl-2-propylbenzene

[2]



(anticlockwise عكس عقارب الساعة)

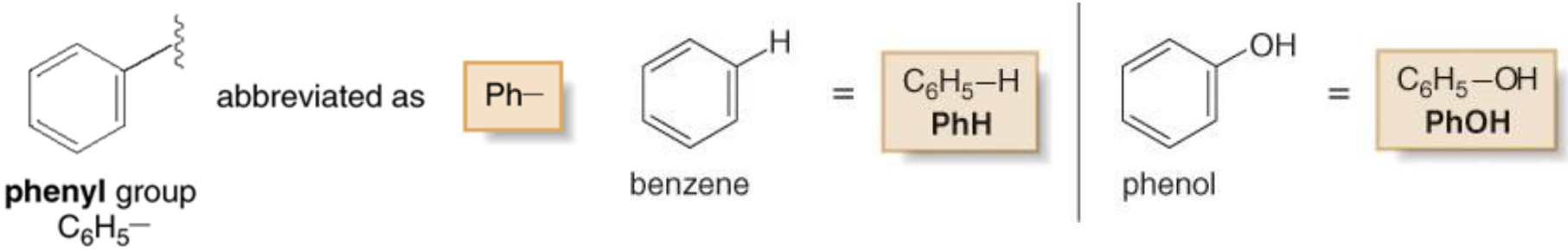
- Name the molecule as a derivative of the common root **aniline** → amino group at benzen ring
- Designate the position of the NH_2 group as "1," and then assign the lowest possible set of numbers to the other substituents.

2,5-dichloroaniline

Nomenclature

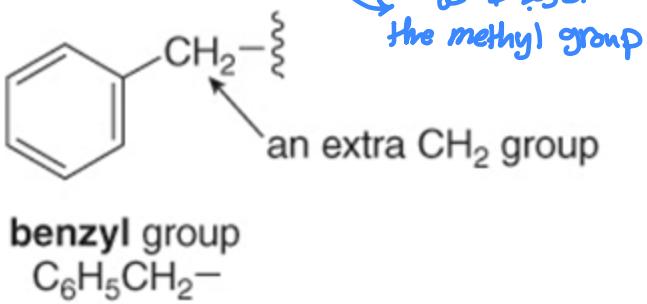
part from another compound

- A benzene substituent is called a phenyl group, and it can be abbreviated in a structure as "Ph-".



- The benzyl group:

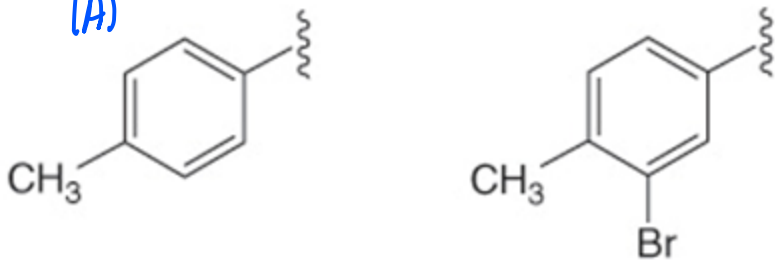
الارتباط من the methyl group



- Aryl groups:

aromatic

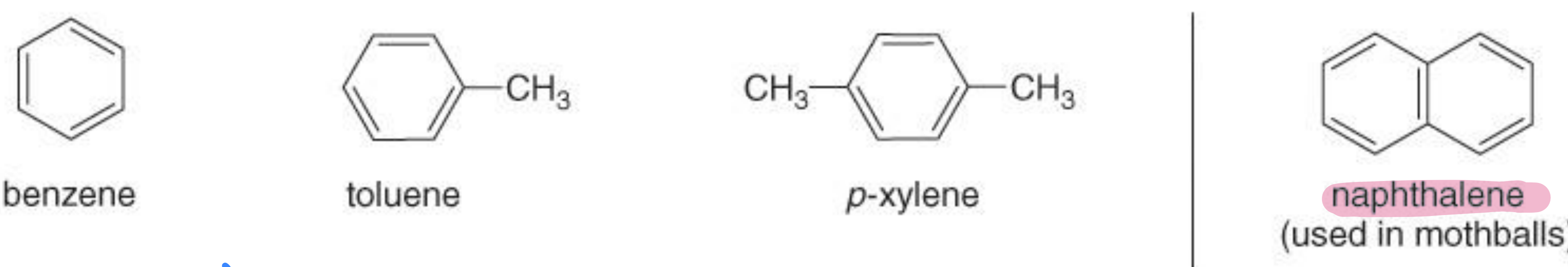
(A)



Interesting Aromatic Compounds

- Benzene and toluene, are obtained from petroleum refining and are useful starting materials for synthetic polymers.
- Compounds containing two or more benzene rings that share carbon—carbon bonds are called polycyclic aromatic hydrocarbons (PAHs). Naphthalene, the simplest PAH, is the active ingredient in mothballs.

The components of the gasoline additive BTX



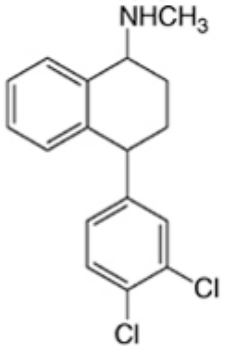
→ properiets (non polar)

→ most of the drugs have benzen reason → more hydrophopic + stronger binding with the receptor

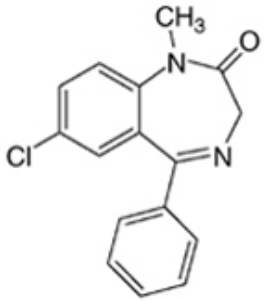
note: drug عشان يتوزع ال
في الجسم لازم يكون في balance
→ hydrophilic
→ hydrophobic → عشان يرتبط مع ال receptor + enzyme

Interesting Aromatic Compounds

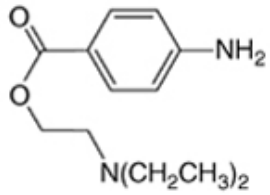
(حش حفظ)



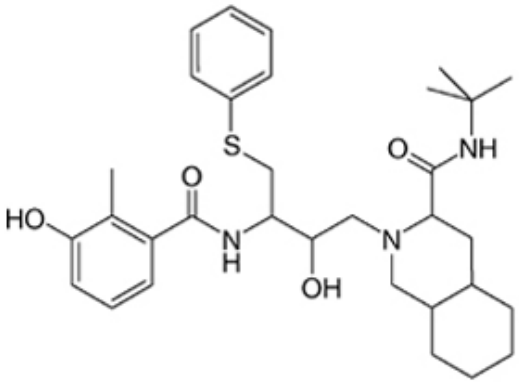
- Trade name: **Zoloft**
- Generic name: **sertraline**
- Use: a psychotherapeutic drug for depression and panic disorders



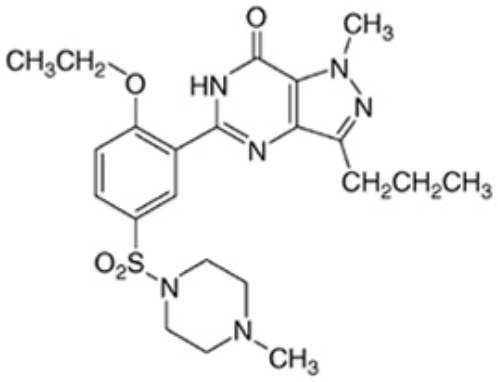
- Trade name: **Valium**
- Generic name: **diazepam**
- Use: a sedative



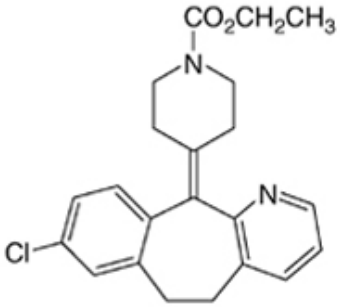
- Trade name: **Novocain**
- Generic name: **procaine**
- Use: a local anesthetic



- Trade name: **Viracept**
- Generic name: **nelfinavir**
- Use: an antiviral drug used to treat HIV



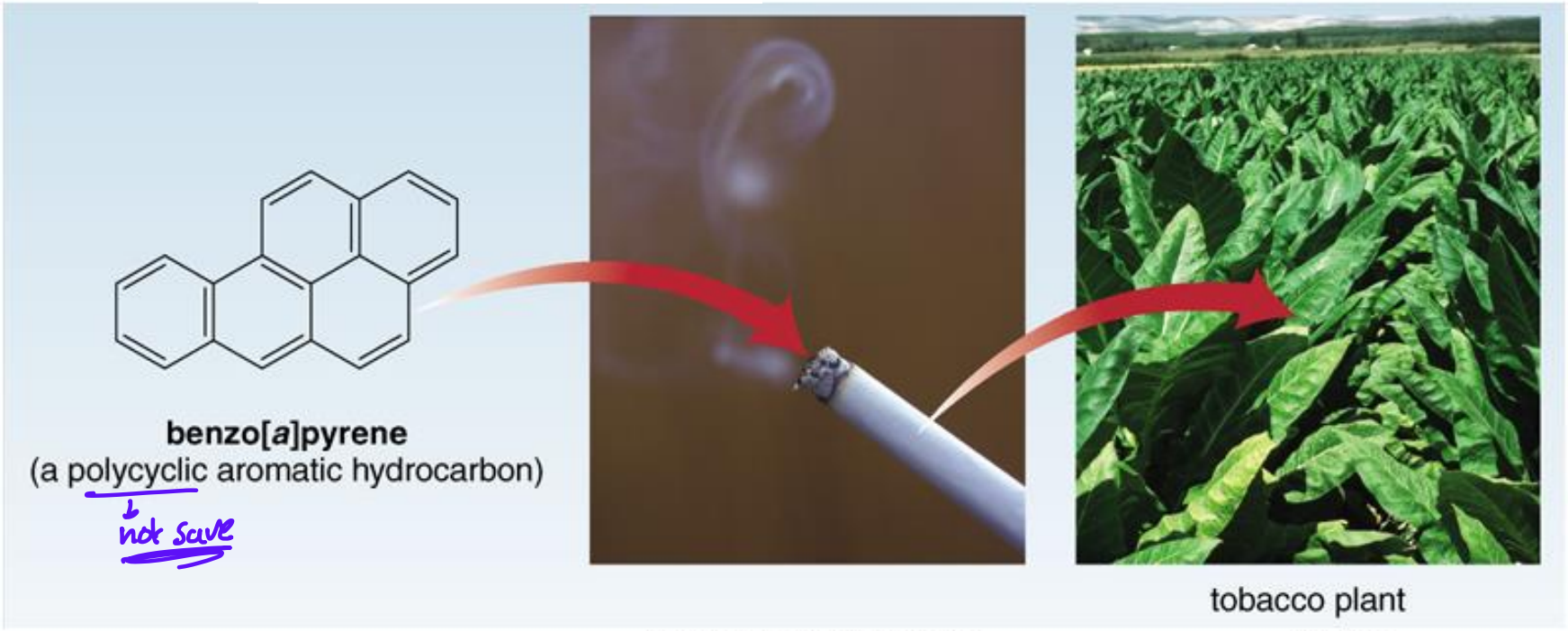
- Trade name: **Viagra**
- Generic name: **sildenafil**
- Use: a drug used to treat erectile dysfunction



- Trade name: **Claritin**
- Generic name: **loratadine**
- Use: an antihistamine for seasonal allergies

Interesting Aromatic Compounds

- Benzo[*a*]pyrene, produced by the incomplete oxidation of organic compounds in tobacco, is found in cigarette smoke.



- When ingested or inhaled, benzo[a]pyrene and other similar PAHs are oxidized to carcinogenic products.

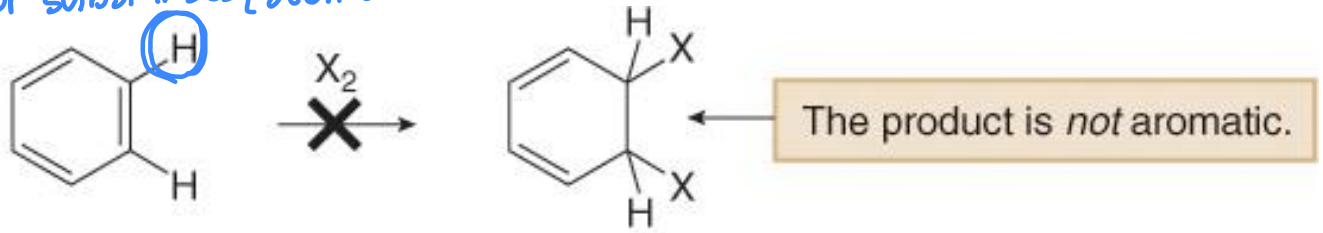
Electrophilic Aromatic Substitution

Chapter 16
Organic Chemistry, *8th Edition*
John McMurry

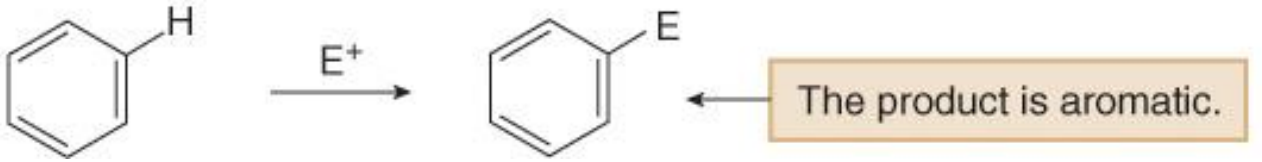
Introduction

electrophilic (add electrons) → poor substances (seek electrons)

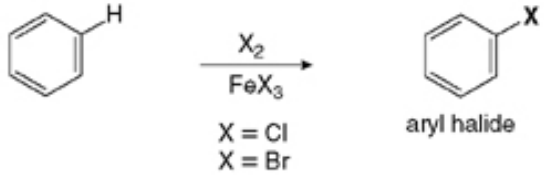
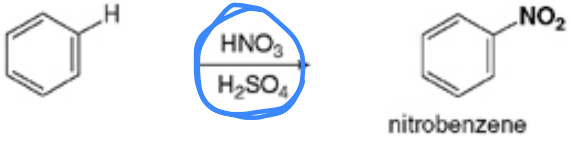
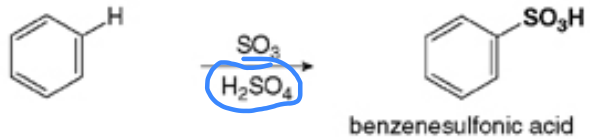
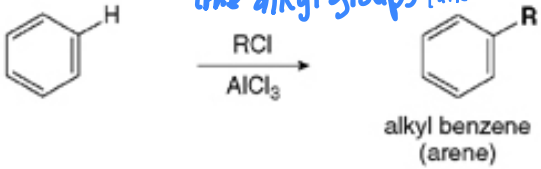
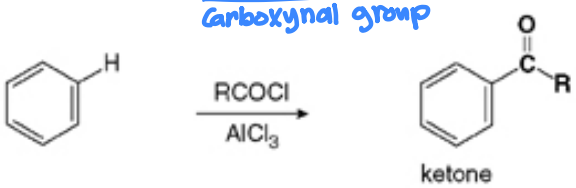
Addition



Substitution (استبدال)



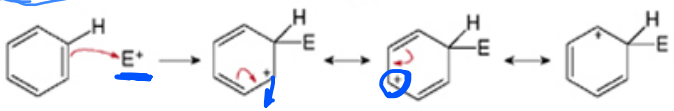
Introduction

Reaction	Electrophile
[1] Halogenation—Replacement of H by X (Cl or Br)	
	$E^+ = Cl^+$ or Br^+
[2] Nitration—Replacement of H by NO_2	
	$E^+ = \overset{+}{N}O_2$
[3] Sulfonation—Replacement of H by SO_3H	
	$E^+ = \overset{+}{S}O_3H$
[4] Friedel–Crafts alkylation—Replacement of H by R	
	$E^+ = R^+$
[5] Friedel–Crafts acylation—Replacement of H by RCO	
	$E^+ = R\overset{+}{C}O$

Mechanism

Mechanism 18.1 General Mechanism—Electrophilic Aromatic Substitution

Step [1] Addition of the electrophile (E^+) to form a carbocation

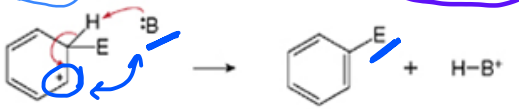


resonance-stabilized carbocation

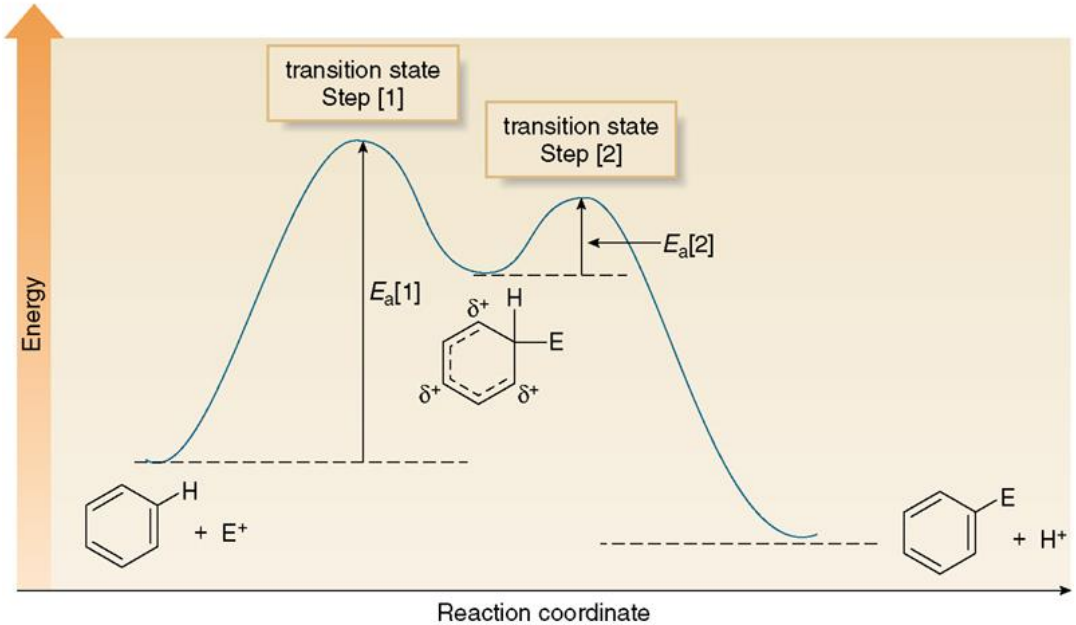
poor carbon (not stable ring) (positively charged)

- Addition of the electrophile (E^+) forms a new C–E bond using two π electrons from the benzene ring, and generating a carbocation. This carbocation intermediate is not aromatic, but it is resonance stabilized—**three resonance structures can be drawn.**
- Step [1] is rate-determining because the aromaticity of the benzene ring is lost.

Step [2] Loss of a proton to re-form the aromatic ring



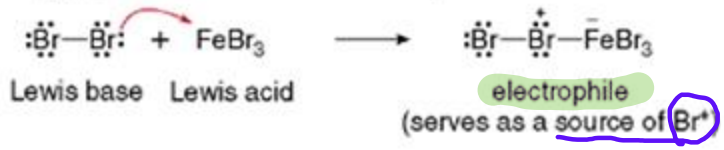
- In Step [2], a base (B:) removes the proton from the carbon bearing the electrophile, thus re-forming the aromatic ring. This step is fast because the aromaticity of the benzene ring is restored.
- Any of the three resonance structures of the carbocation intermediate can be used to draw the product. The choice of resonance structure affects how curved arrows are drawn, but not the identity of the product.



Halogenation

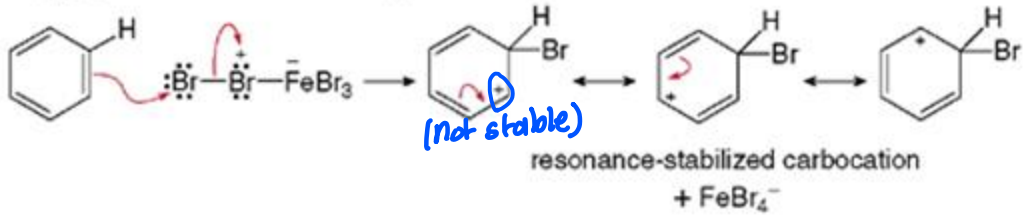
Mechanism 18.2 Bromination of Benzene

Step [1] Generation of the electrophile



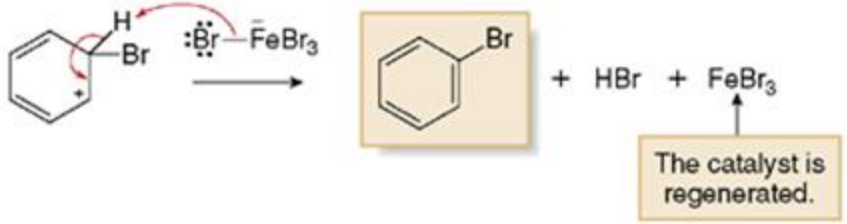
- Lewis acid–base reaction of Br_2 with $FeBr_3$ forms a species with a weakened and polarized Br – Br bond. This adduct serves as a source of Br^+ in the next step.

Step [2] Addition of the electrophile to form a carbocation



- Addition of the electrophile forms a new C – Br bond and generates a carbocation. This carbocation intermediate is resonance stabilized—**three resonance structures can be drawn.**
- The $FeBr_4^-$ also formed in this reaction is the base used in Step [3].

Step [3] Loss of a proton to re-form the aromatic ring



- $FeBr_4^-$ removes the proton from the carbon bearing the Br, thus re-forming the aromatic ring.
- $FeBr_3$, a catalyst, is also regenerated for another reaction cycle.