Aspirin

Risk of bleeds and death with daily aspirin use higher than thought

Research suggests 3,000 people die a year in UK from long-term use of aspirin or similar drugs, but also taking heartburn medication could help reduce risk

Haroon Siddique
Wed 14 Jun 2017 06.05 BST

most popular
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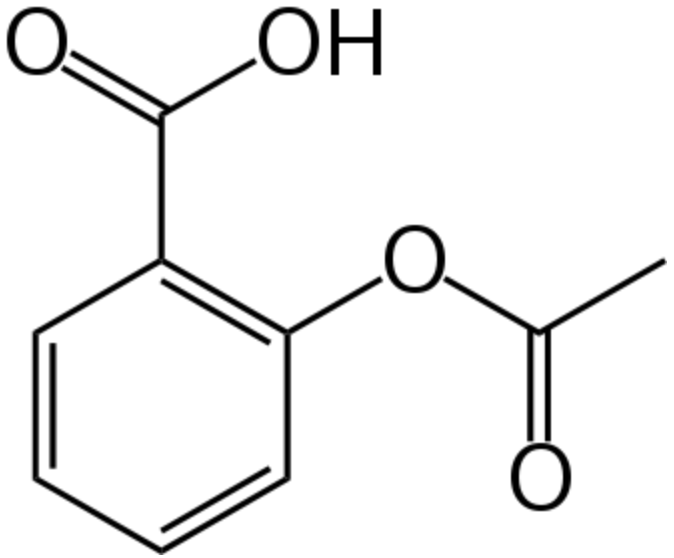
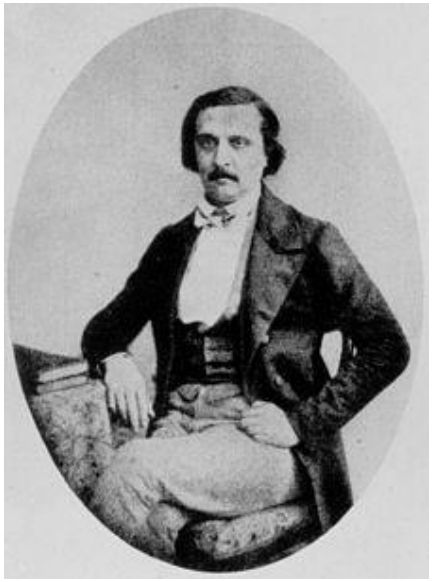
But Prof Peter Rothwell, from Oxford University and the lead author of the study, said there are about 20,000 major bleeds and around 3,000 deaths caused by aspirin or other antiplatelet drugs each year

Aspirin



One of the most used globally

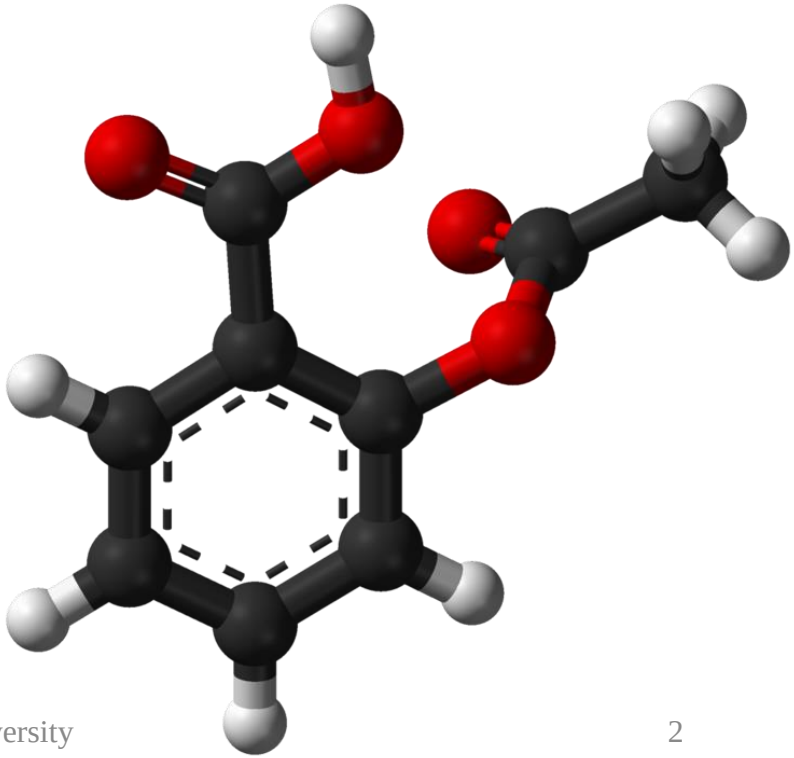
50 – 120 billion pills/year



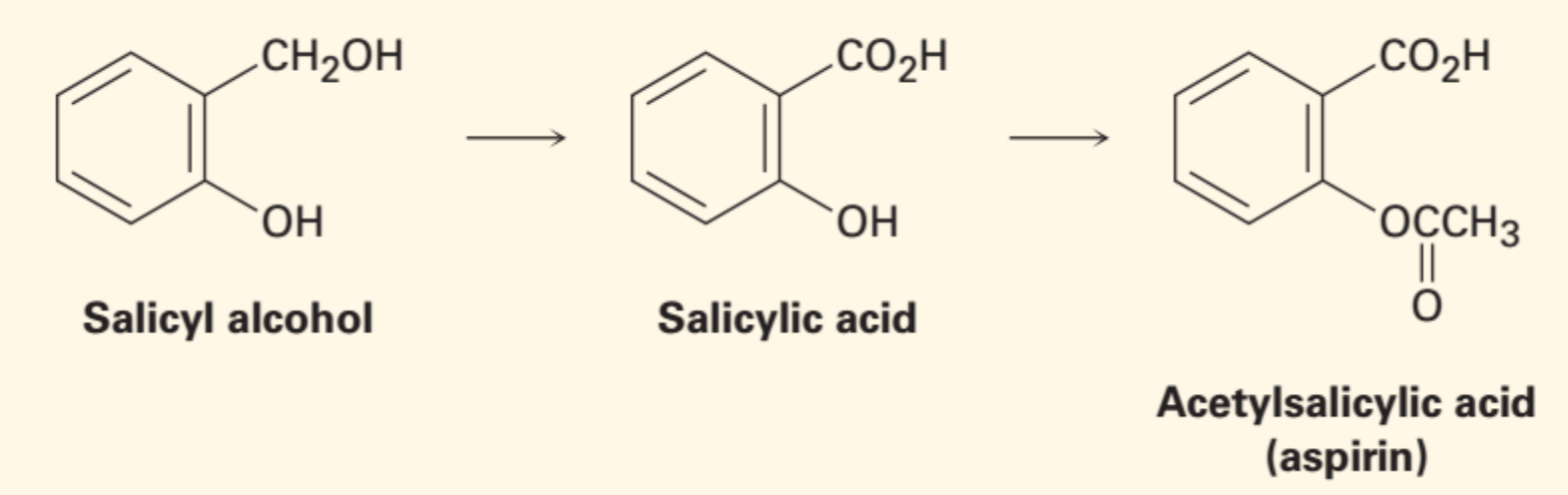
Charles Frédéric Gerhardt

1853: first time synthesis

1899: on market

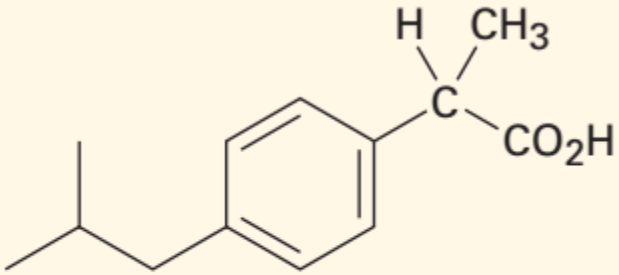


Aspirin

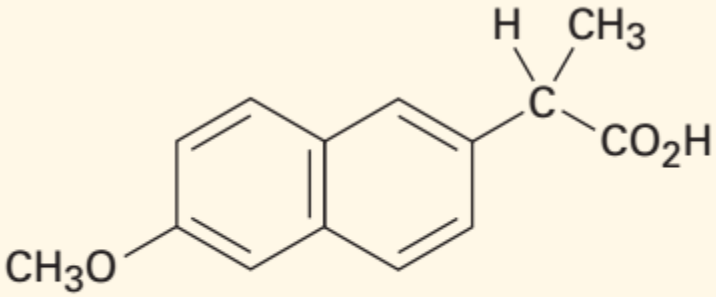


to treat pain, fever, or inflammation

Similar to aspirin

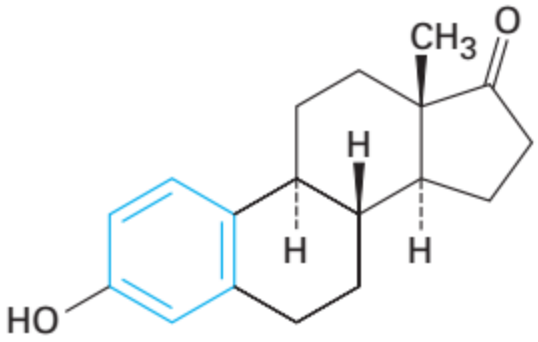


Ibuprofen
(Advil, Nuprin, Motrin)

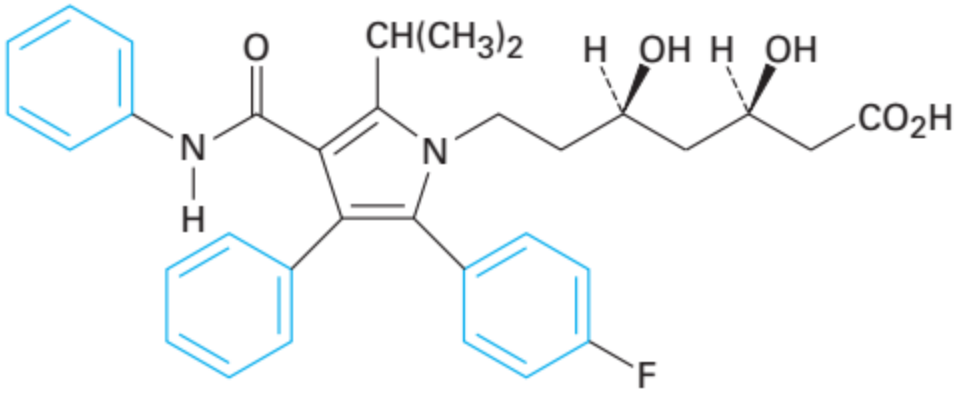


Naproxen
(Aleve, Naprosyn)

Example



Estrone

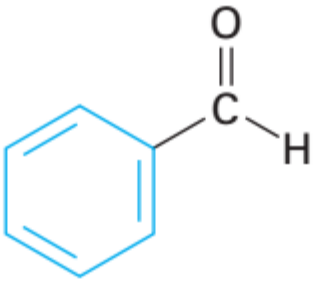


Atorvastatin (Lipitor)

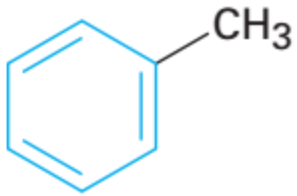
Cholesterol-lowering drug

Example

Benzene



Benzaldehyde



Toluene

Organic Chemistry

CHE 203

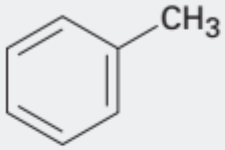
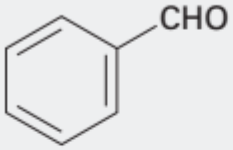
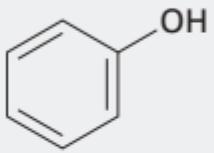
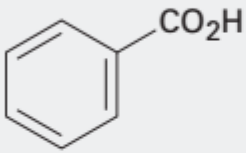
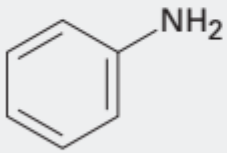
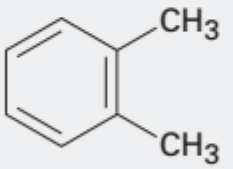
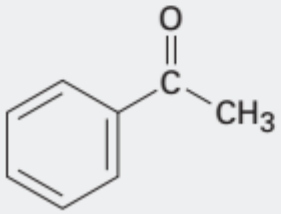
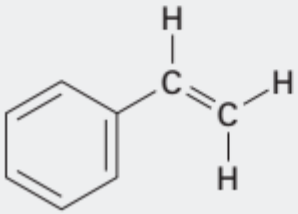
Lecture 11: Benzene Aromaticity

Le Quoc Chon – Duy Tan University

Tên hợp chất aromatic

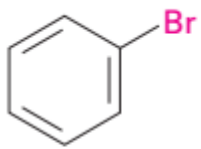
Naming Aromatic compounds

TABLE 15-1 Common Names of Some Aromatic Compounds

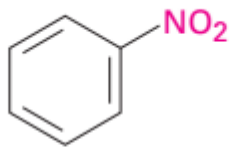
Structure	Name	Structure	Name
	Toluene (bp 111 °C)		Benzaldehyde (bp 178 °C)
	Phenol (mp 43 °C)		Benzoic acid (mp 122 °C)
	Aniline (bp 184 °C)		*ortho*-Xylene (bp 144 °C)
	Acetophenone (mp 21 °C)		Styrene (bp 145 °C)

Tên hợp chất aromatic

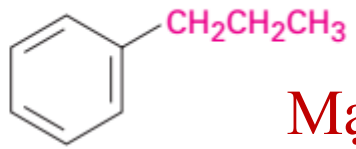
Naming Aromatic compounds



Bromobenzene



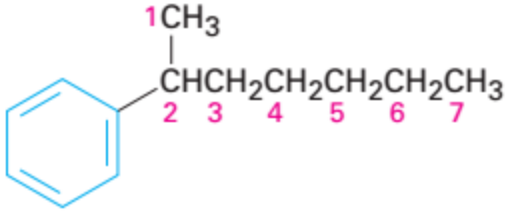
Nitrobenzene



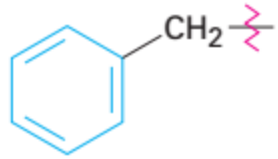
Propylbenzene

Mạch nhánh ngắn

A phenyl group



2-Phenylheptane



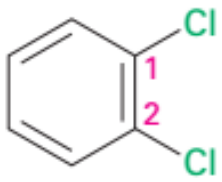
A benzyl group

Viết tắt: Ph

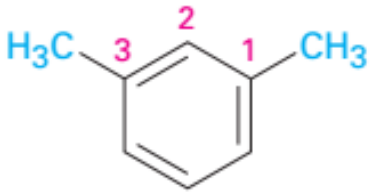
Mạch nhánh dài

Tên hợp chất aromatic

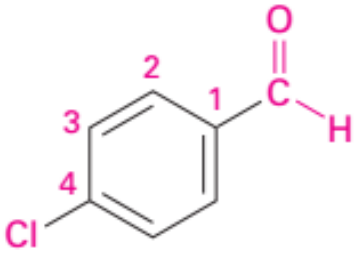
Naming Aromatic compounds



***ortho*-Dichlorobenzene**
1,2 disubstituted

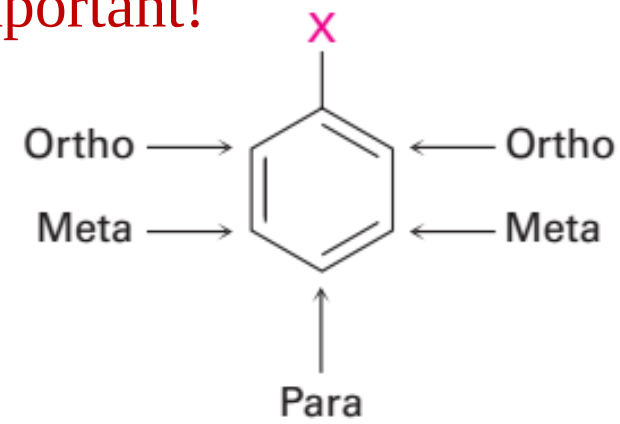


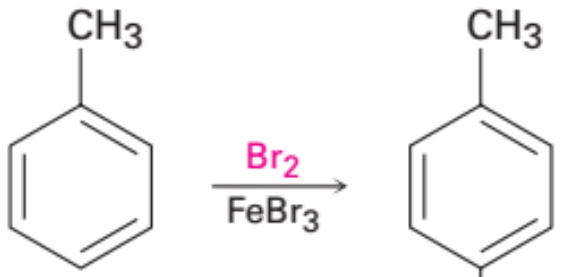
***meta*-Dimethylbenzene**
(*meta*-xylene)
1,3 disubstituted



***para*-Chlorobenzaldehyde**
1,4 disubstituted

This is important!



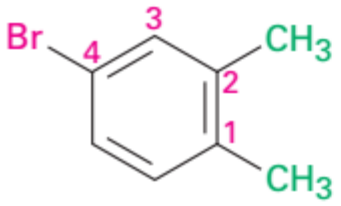


Toluene **p-Bromotoluene**

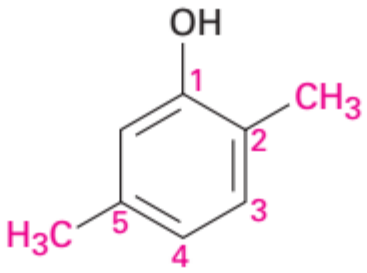
This reaction occurs at the para position

Naming Aromatic compounds

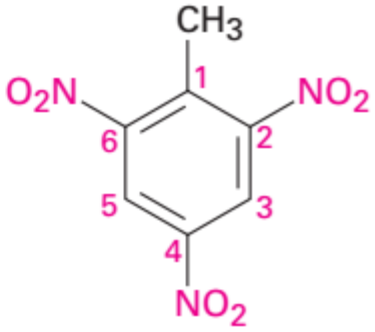
Chọn vị trí bắt đầu đếm nhóm thế sao cho nhóm thứ 2, 3, 4 có vị trí đếm nhỏ nhất có thể. Đọc theo thứ tự alphabet



4-Bromo-1,2-dimethylbenzene



2,5-Dimethylphenol



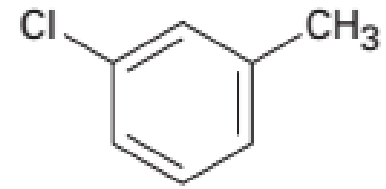
2,4,6-Trinitrotoluene (TNT)

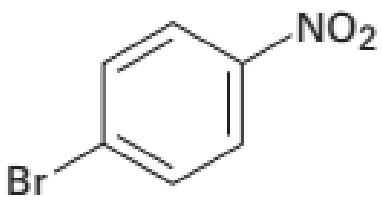
Problem

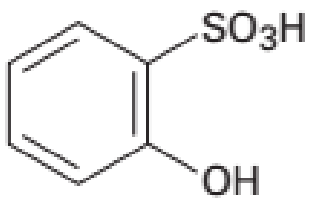
Vị trí các nhóm thế ở ortho, meta hay para với nhau

PROBLEM 15-1

Tell whether the following compounds are ortho-, meta-, or para-disubstituted:

(a) 

(b) 

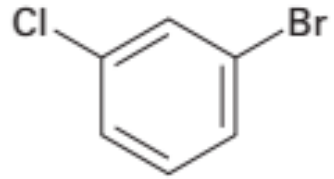
(c) 

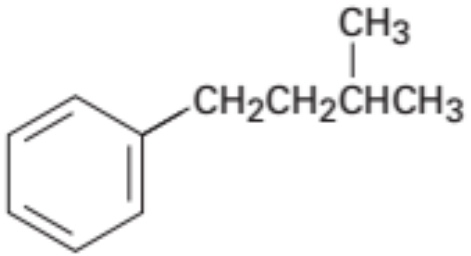
Problem

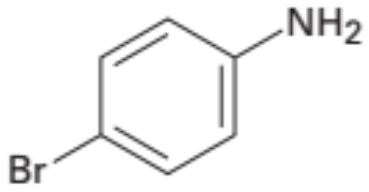
Đọc tên IUPAC các chất sau

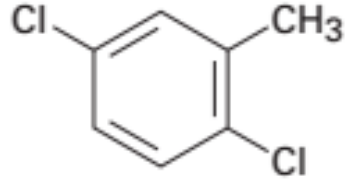
PROBLEM 15-2

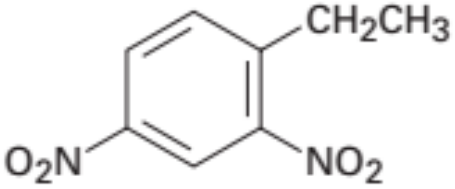
Give IUPAC names for the following compounds:

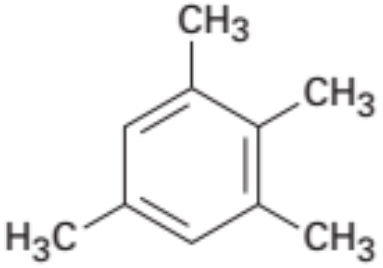
(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

Problem

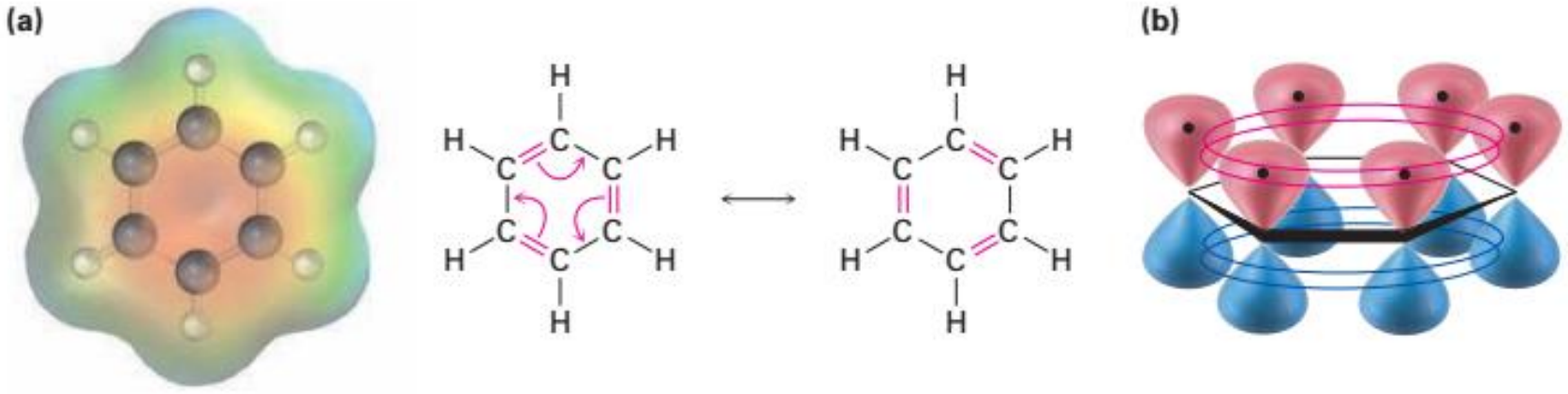
Vẽ công thức cấu tạo các chất sau

PROBLEM 15·3

Draw structures corresponding to the following IUPAC names:

(a) *p*-Bromochlorobenzene **(b)** *p*-Bromotoluene
(c) *m*-Chloroaniline **(d)** 1-Chloro-3,5-dimethylbenzene

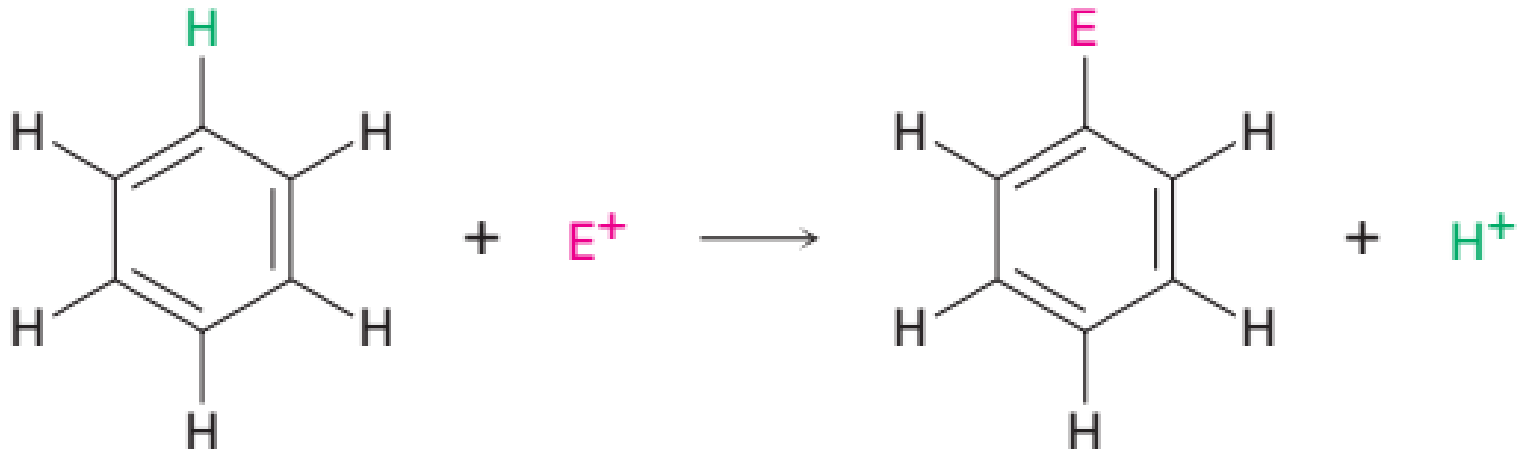
Structure of Benzene (cấu trúc của Benzene)



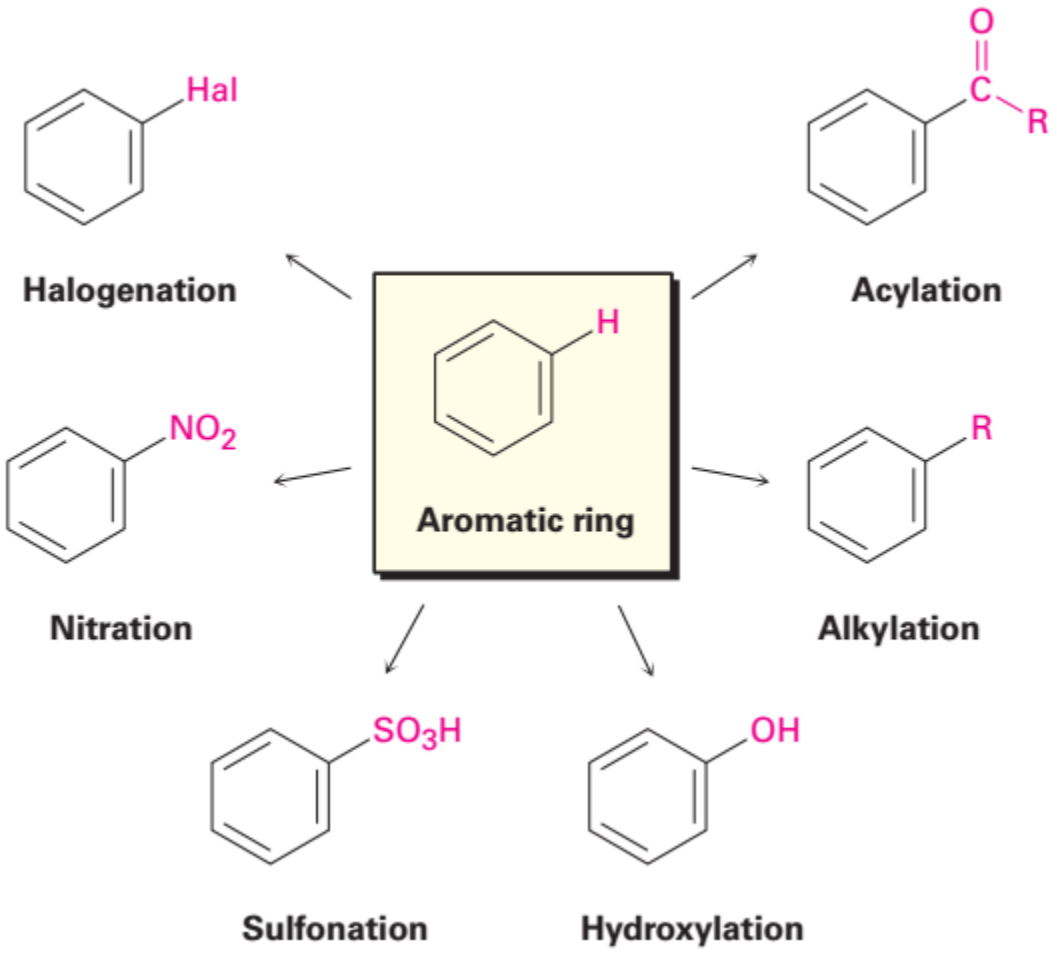
sp^2 hybridized,
C-C 139 pm
C-C-C angle 120°
6 bonds in the ring are equivalent

Electrophilic Aromatic substitution

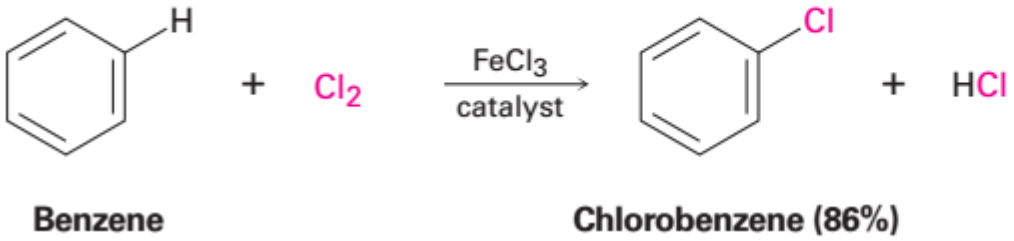
(phản ứng thế ái điện tử lên vòng aromatic)



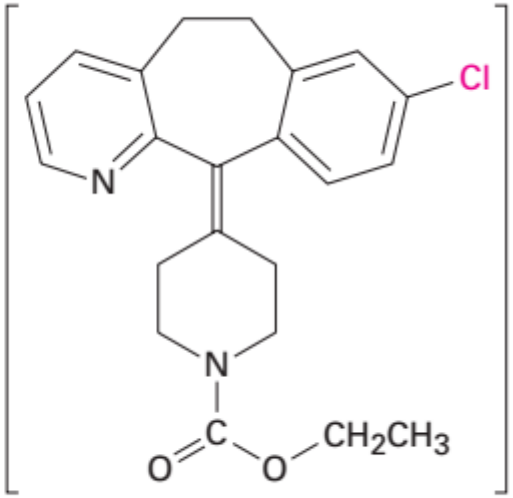
Electrophilic Aromatic substitution



Applications of Electrophilic Aromatic substitution



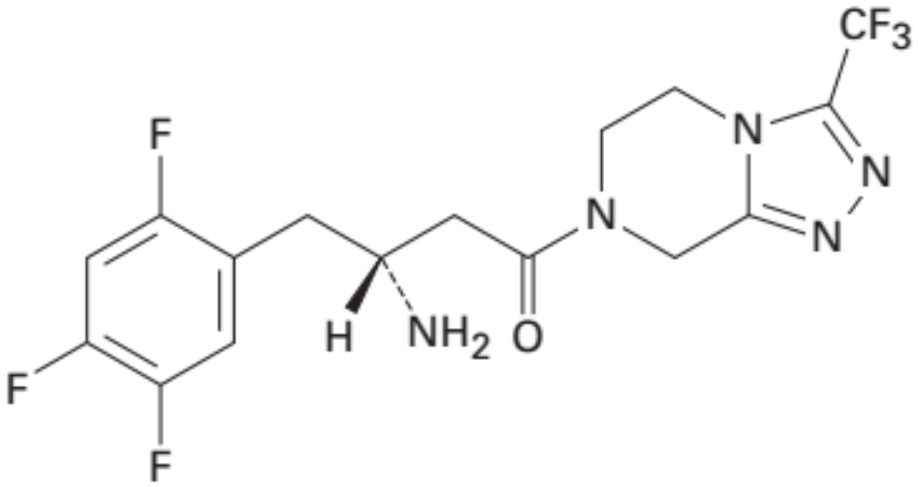
Benzene **Chlorobenzene (86%)**



Loratadine

(antiallergy)

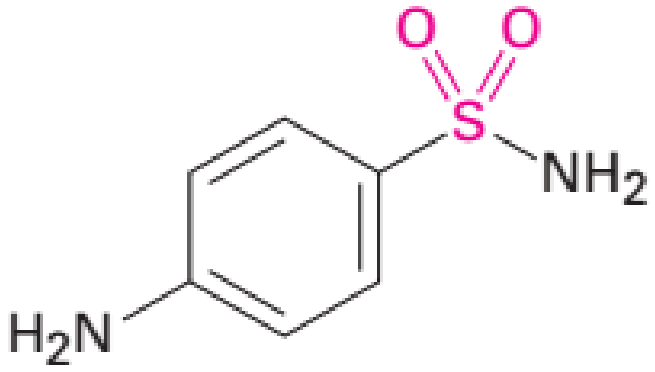
Applications of Electrophilic Aromatic substitution



Sitagliptin
(Januvia)

(antidiabetic drug: type 2)

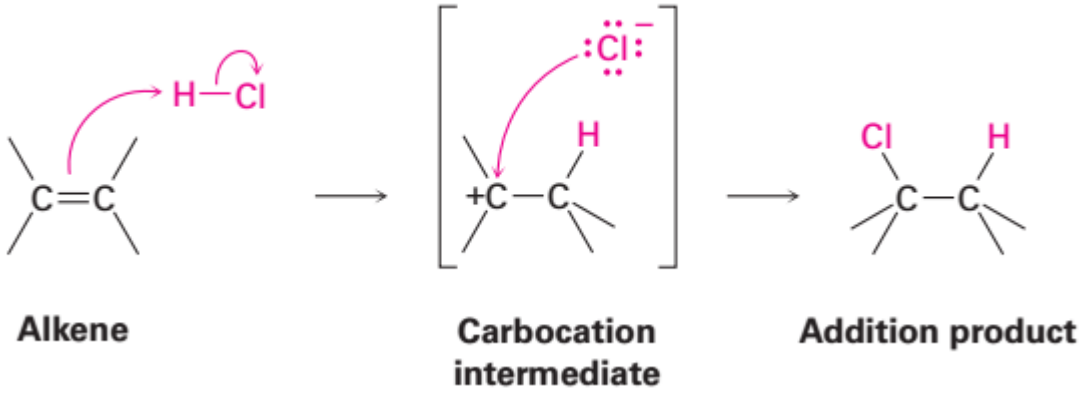
Applications of Electrophilic Aromatic substitution



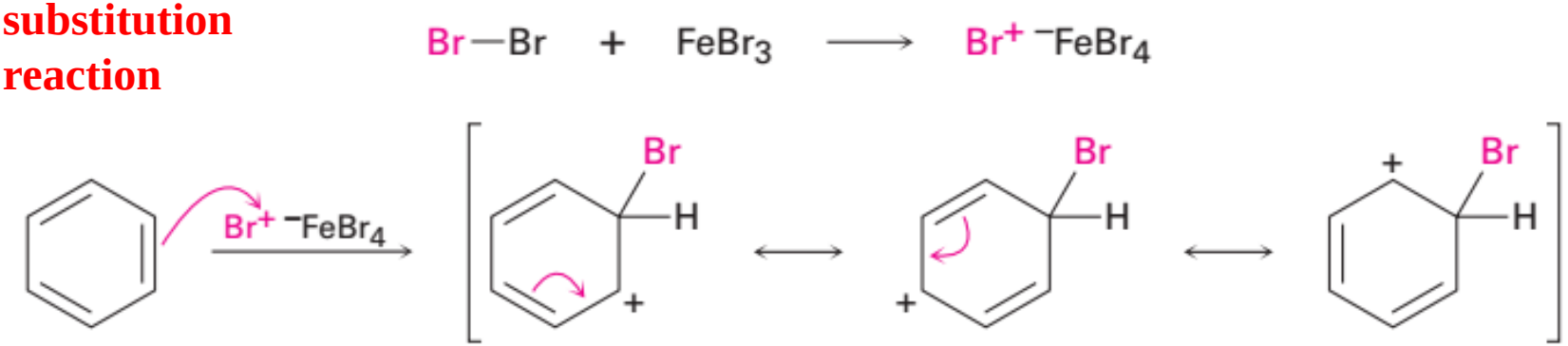
Sulfanilamide (an antibiotic)

Electrophilic Aromatic substitution

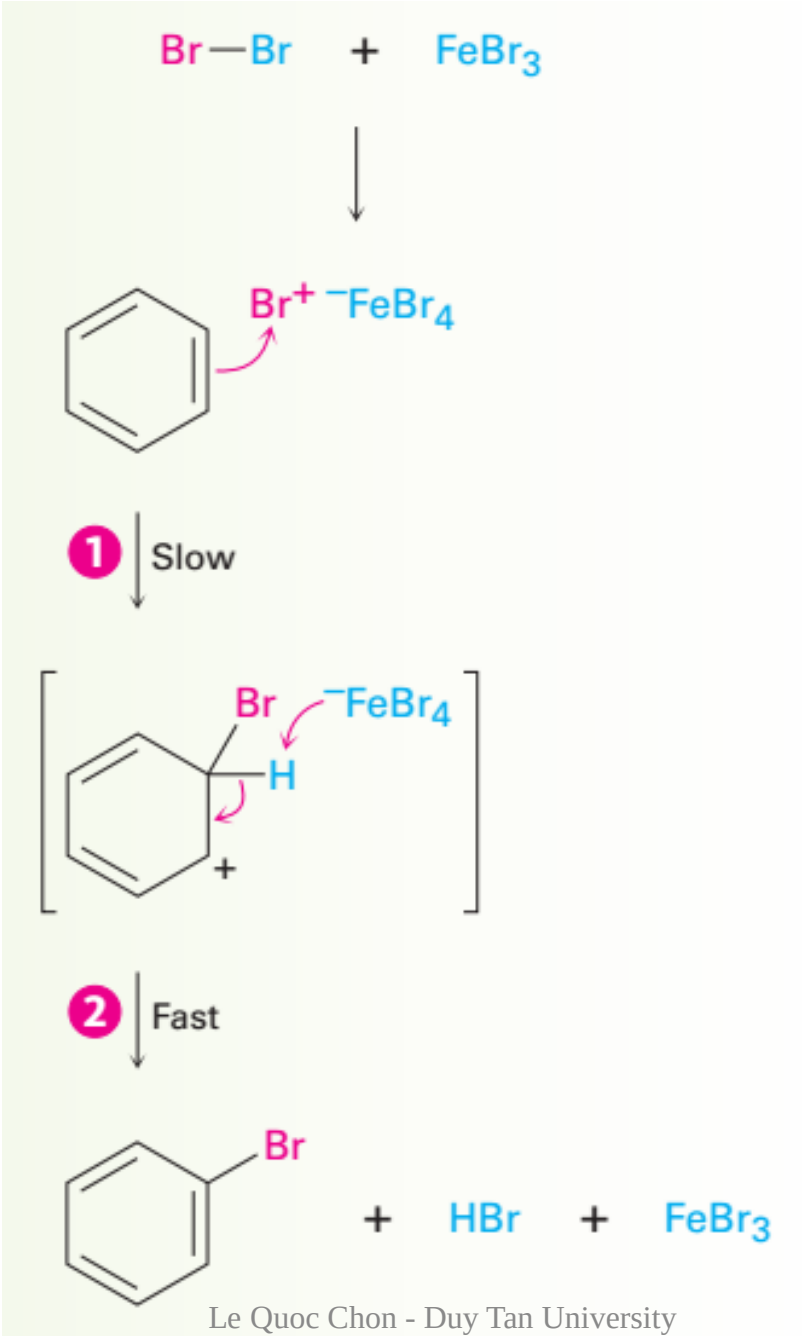
Alkene: addition reaction



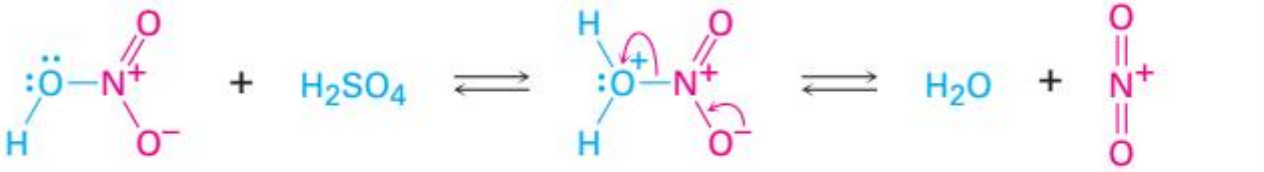
Aromatic: substitution reaction



Cơ chế

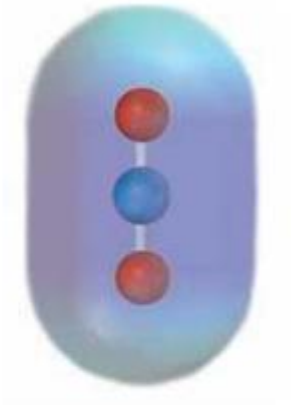


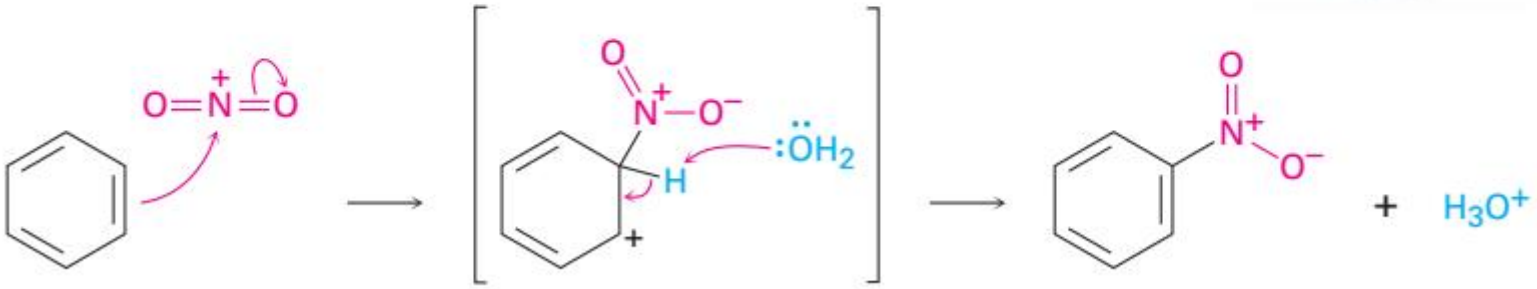
Aromatic nitration



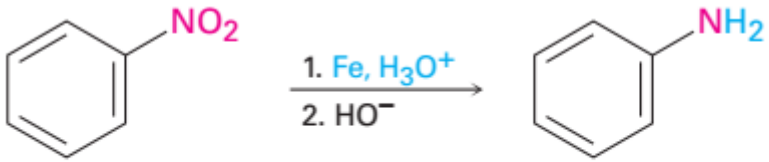
Nitric acid

Nitronium ion





Nitrobenzene



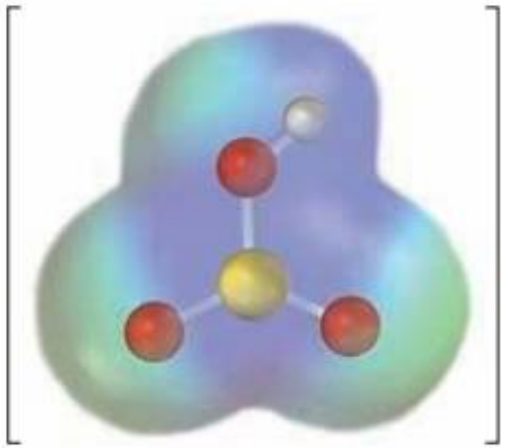
Nitrobenzene

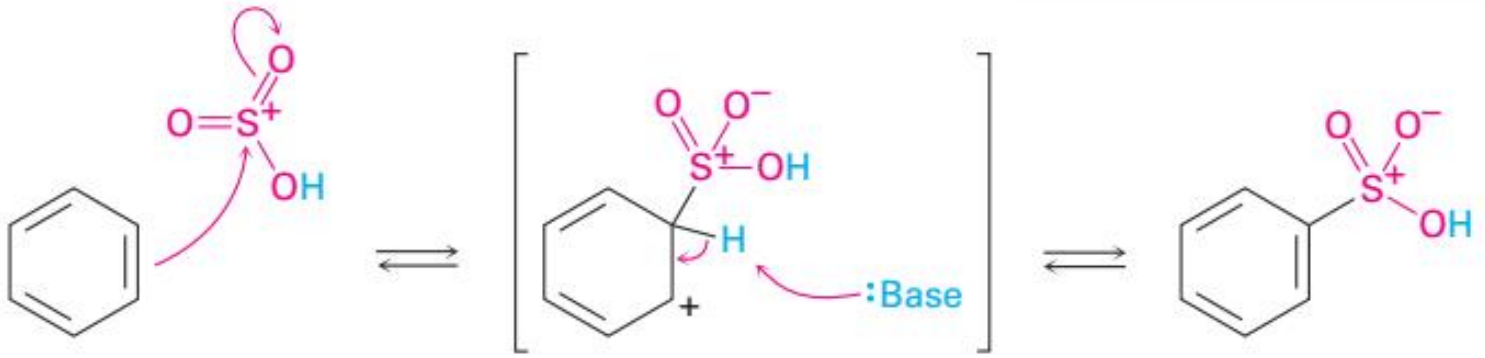
Aniline (95%)

Aromatic sulfonation

(hỗn hợp của $SO_3 + H_2SO_4$)

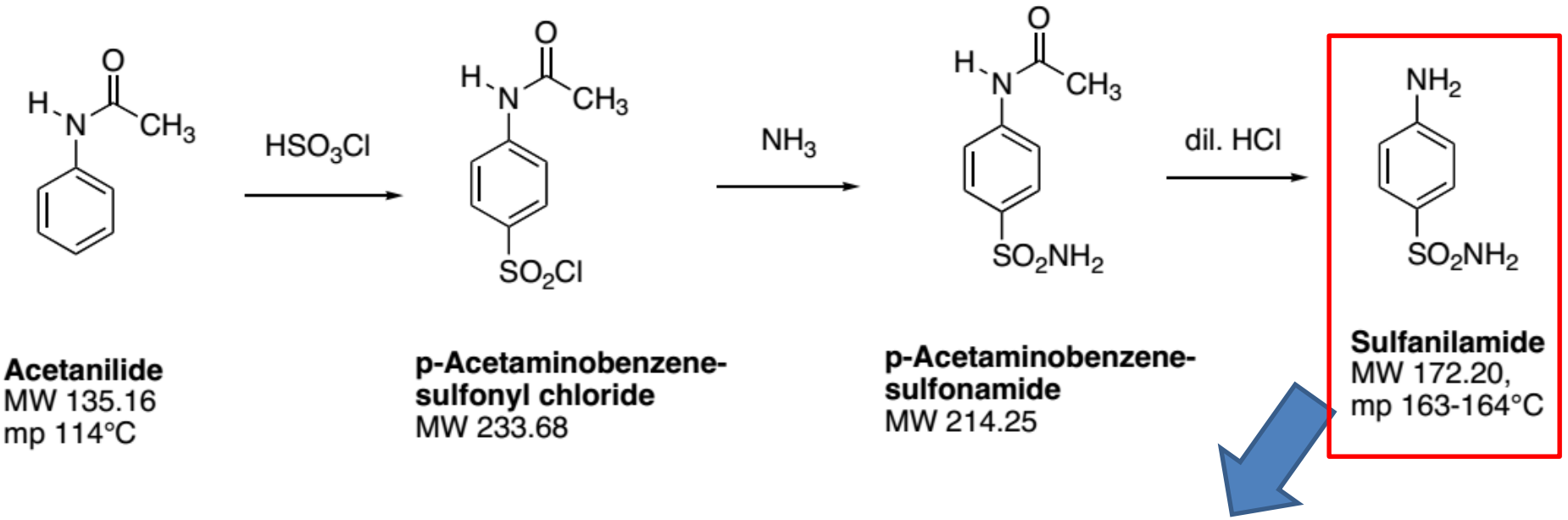
Sulfur trioxide





Benzenesulfonic acid

Tổng hợp sulfanilamide



Acetanilide
MW 135.16
mp 114°C

p-Acetaminobenzene-sulfonyl chloride
MW 233.68

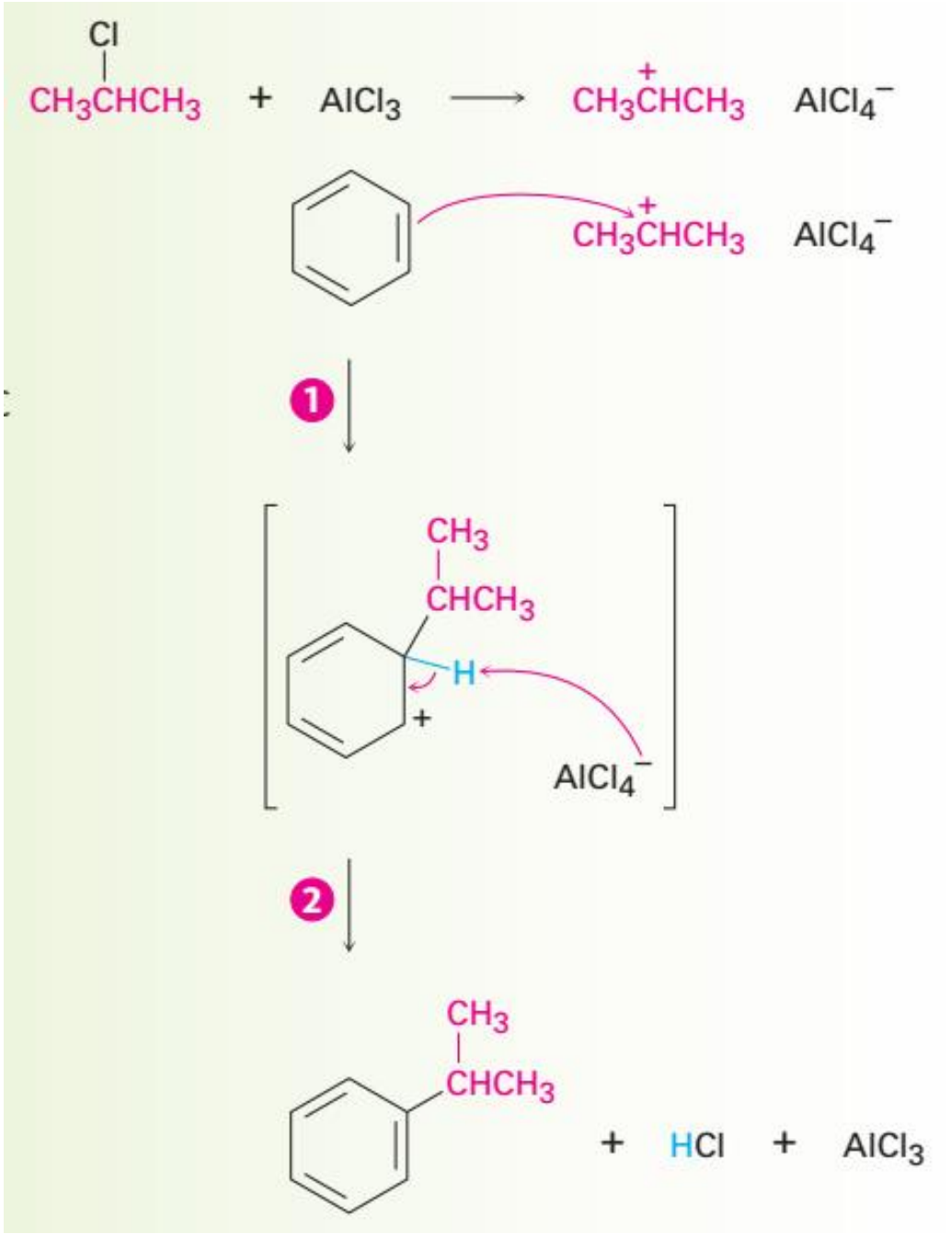
p-Acetaminobenzene-sulfonamide
MW 214.25

Sulfanilamide
MW 172.20,
mp 163-164°C

Past: antibiotic
Now: treat vaginal yeast infections

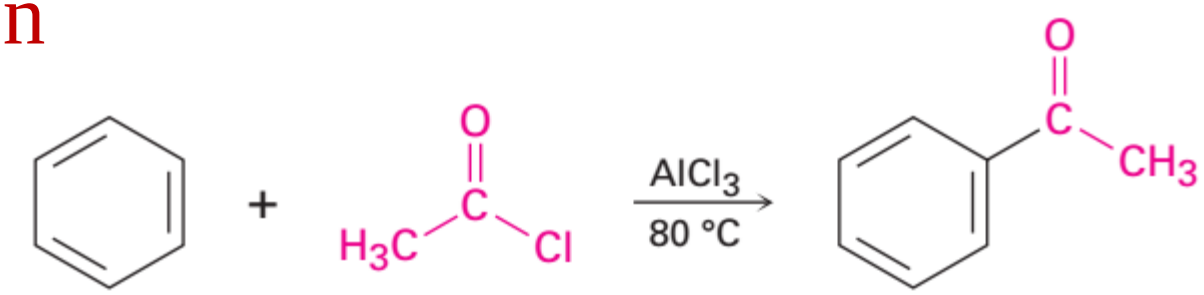
The Friedel-Crafts Reaction

alkylation

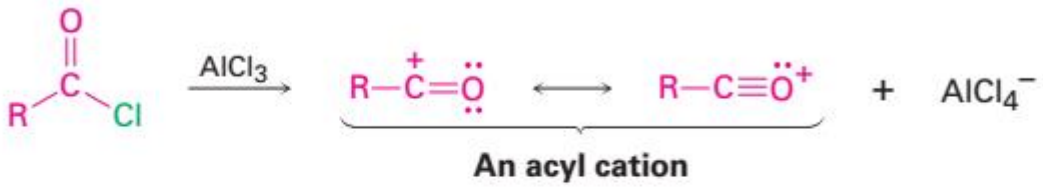


The Friedel-Crafts Reaction

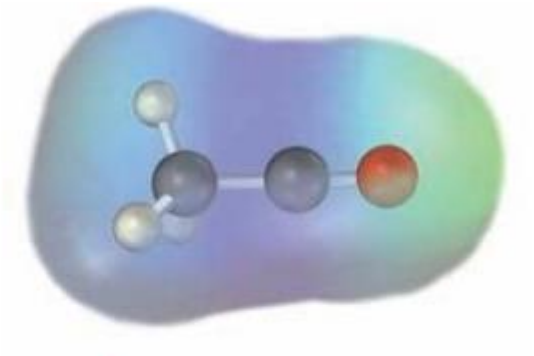
Acylation

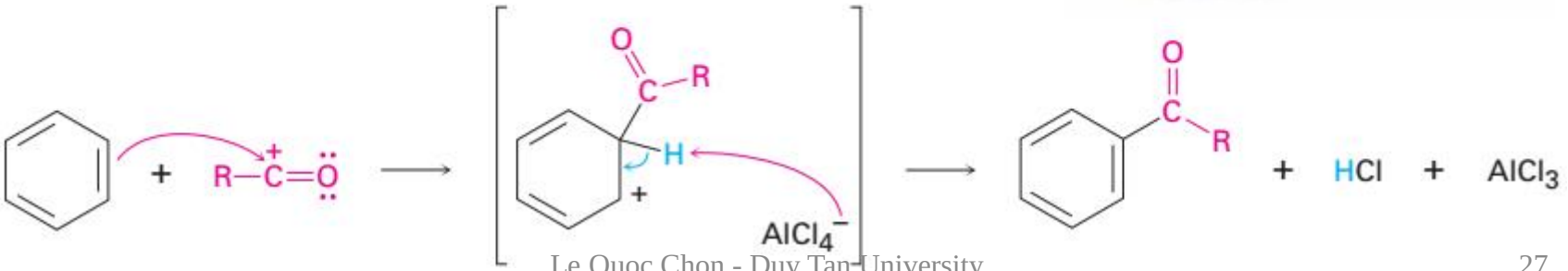


Benzene **Acetyl chloride** **Acetophenone (95%)**



An acyl cation





Problem

The Friedel–Crafts reaction of benzene with 2-chloro-3-methylbutane in the presence of $AlCl_3$ occurs with a carbocation rearrangement. What is the structure of the product?

Problem

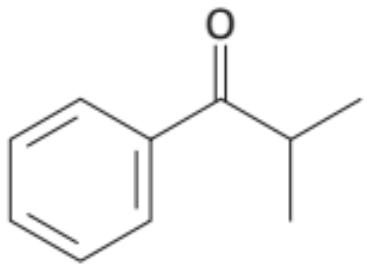
PROBLEM 16-6

What is the major monosubstitution product from the Friedel–Crafts reaction of benzene with 1-chloro-2-methylpropane in the presence of $AlCl_3$?

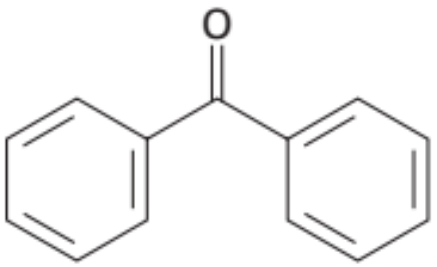
PROBLEM 16-7

Identify the carboxylic acid chloride that might be used in a Friedel–Crafts acylation reaction to prepare each of the following acylbenzenes:

(a)

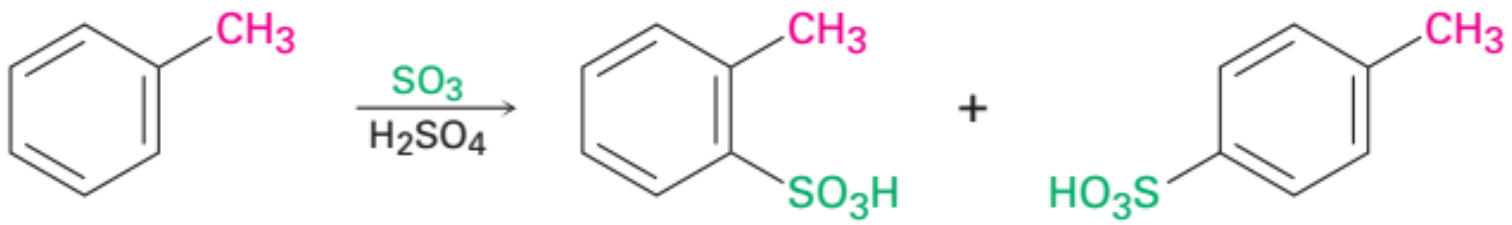


(b)



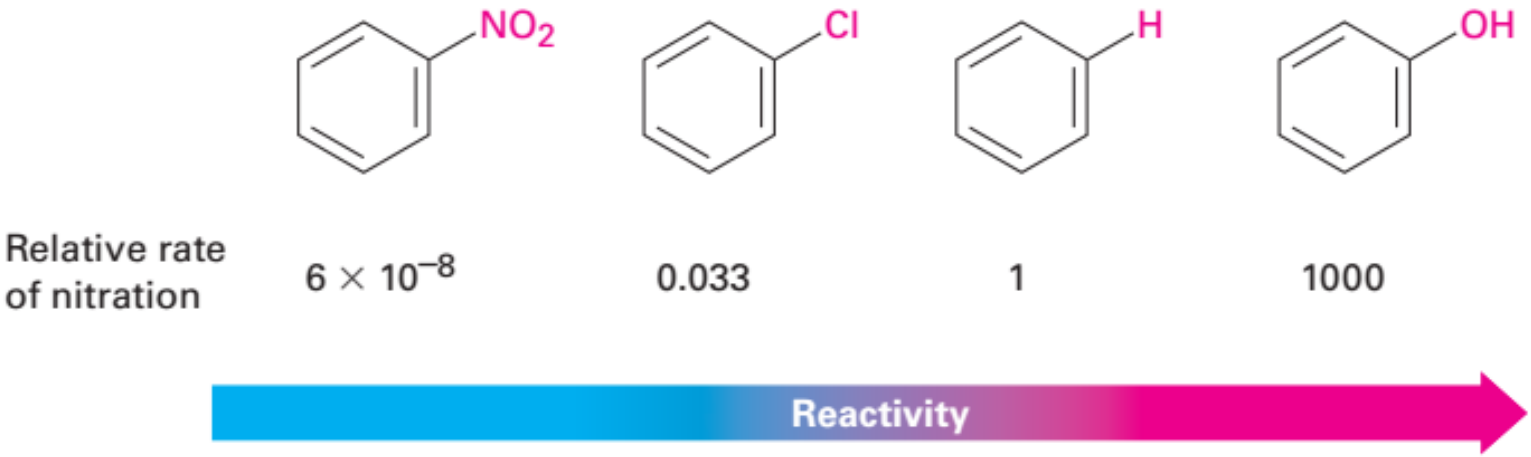
Effect of substituents in electrophilic substitutions

Predict the major product of the sulfonation of toluene.



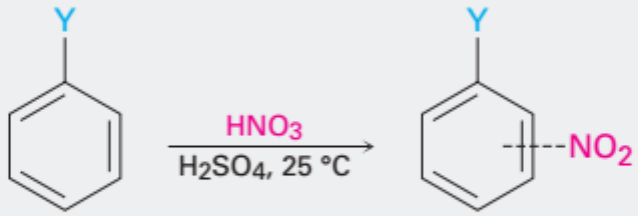
Toluene **o-Toluenesulfonic acid** **p-Toluenesulfonic acid**

Effect of substituents in electrophilic substitutions



Effect of substituents in electrophilic substitutions

TABLE 16-1 Orientation of Nitration in Substituted Benzenes



	Product (%)		
	Ortho	Meta	Para
Meta-directing deactivators			
$-\overset{+}{N}(CH_3)_3$	2	87	11
$-NO_2$	7	91	2
$-CO_2H$	22	76	2
$-CN$	17	81	2
$-CO_2CH_3$	28	66	6
$-COCH_3$	26	72	2
$-CHO$	19	72	9
Ortho- and para-directing deactivators			
$-F$	13	1	86
$-Cl$	35	1	64
$-Br$	43	1	56
$-I$	45	1	54
Ortho- and para-directing activators			
$-CH_3$	63	3	34
$-OH$	50	0	50
$-NHCOCH_3$	19	2	79

Effect of substituents in electrophilic substitutions

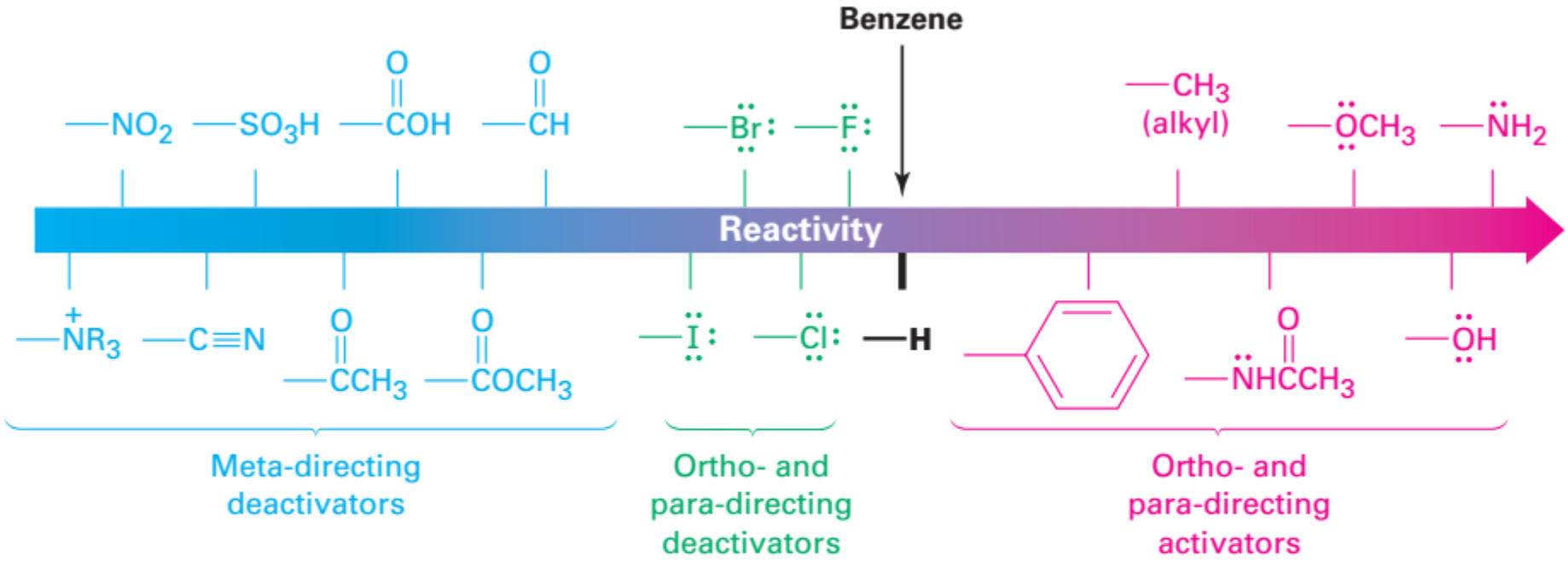


FIGURE 16-11 Classification of substituent effects in electrophilic aromatic substitution. All activating groups are ortho- and para-directing, and all deactivating groups other than halogen are meta-directing. The halogens are unique in being deactivating but ortho- and para-directing.

Effect of substituents in electrophilic substitutions

TABLE 16-2 Substituent Effects in Electrophilic Aromatic Substitution

Substituent	Reactivity	Orienting effect	Inductive effect	Resonance effect
$-CH_3$	Activating	Ortho, para	Weak donating	—
$-OH$, $-NH_2$	Activating	Ortho, para	Weak withdrawing	Strong donating
$-F$, $-Cl$ $-Br$, $-I$	Deactivating	Ortho, para	Strong withdrawing	Weak donating
$-NO_2$, $-CN$, $-CHO$, $-CO_2R$ $-COR$, $-CO_2H$	Deactivating	Meta	Strong withdrawing	Strong withdrawing

Important

Problem

PROBLEM 16-8

Rank the compounds in each of the following groups in order of their reactivity to electrophilic substitution:

(a) Nitrobenzene, phenol, toluene, benzene
(b) Phenol, benzene, chlorobenzene, benzoic acid
(c) Benzene, bromobenzene, benzaldehyde, aniline

Problem

PROBLEM 16-9

Predict the major products of the following reactions:

(a) Nitration of bromobenzene
(b) Bromination of nitrobenzene
(c) Chlorination of phenol
(d) Bromination of aniline