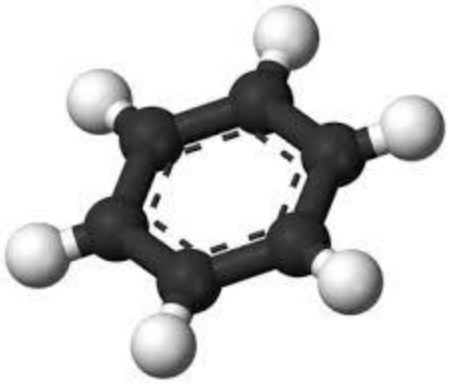
Aromatic – Nomenclature and Properties



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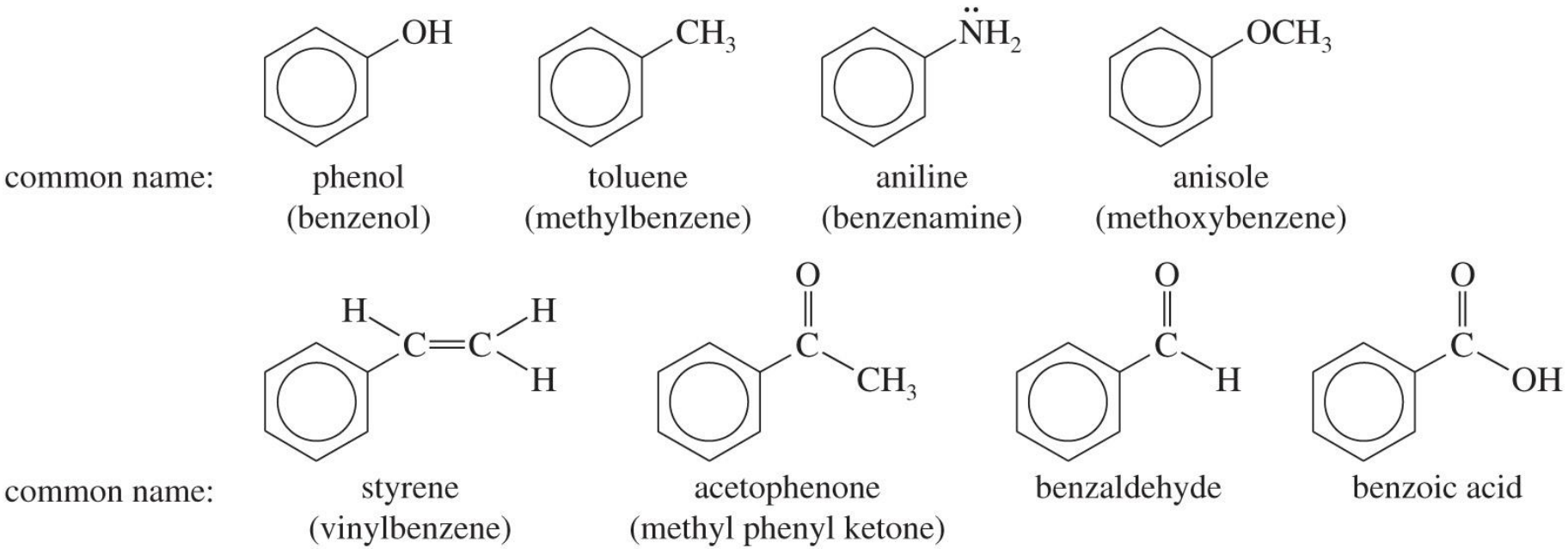
Recommended Textbook:

Chapter 16 in *Organic Chemistry*, 8th Edition, L. G. Wade, Jr., **2010**, Prentice Hall (Pearson Education)

Nomenclature

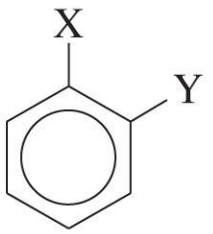
Common Names of Benzene Derivatives

The following compounds are usually called by their **historical common names**, and almost never by the systematic IUPAC names:

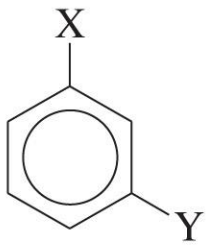


Nomenclature - Disubstituted Benzenes

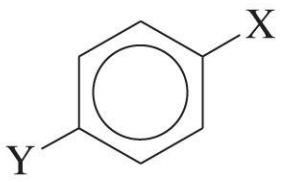
- named using the **prefixes** ***ortho-***, ***meta-***, and ***para-*** to specify the substitution patterns (abbreviated ***o-***, ***m-***, and ***p-***).
- **Numbers** can also be used for the **IUPAC** name.



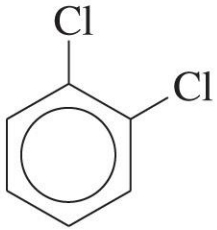
1,2 or ortho

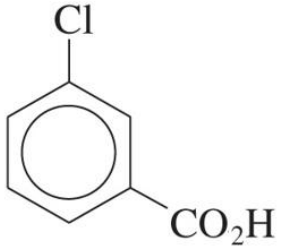


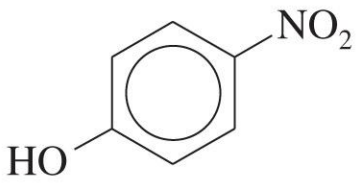
1,3 or meta



1,4 or para



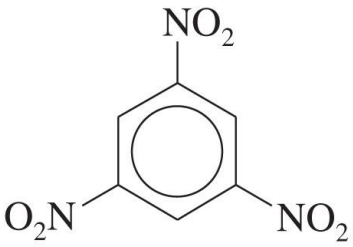




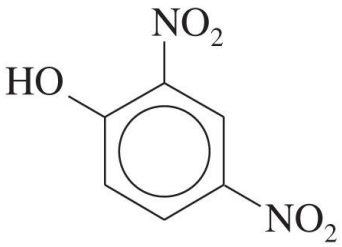
common name:	*o*-dichlorobenzene	*m*-chlorobenzoic acid	*p*-nitrophenol
IUPAC name:	1,2-dichlorobenzene	3-chlorobenzoic acid	4-nitrophenol

Nomenclature - Three or More Substituents

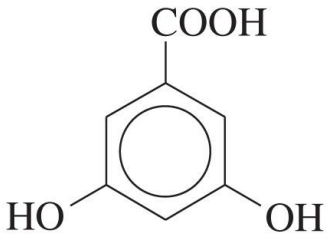
- **Numbers** are used to indicate their positions.
- Assign the numbers to give the **lowest possible numbers** to the substituents.
- The carbon atom **bearing the functional group that defines the base name** (as in phenol or benzoic acid) is assumed to be **C1**.



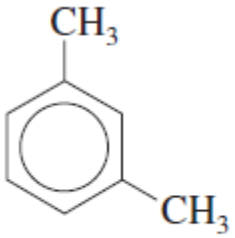
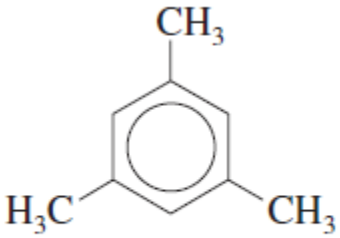
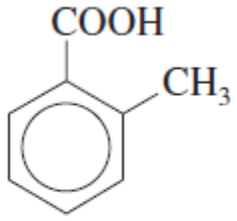
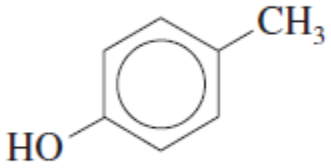
1,3,5-trinitrobenzene



2,4-dinitrophenol

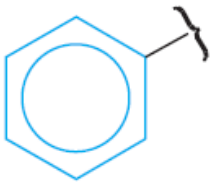


3,5-dihydroxybenzoic acid

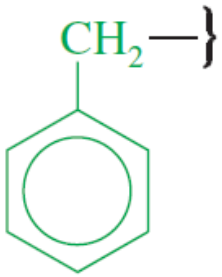
				
common name:	*m*-xylene	mesitylene	*o*-toluic acid	*p*-cresol
IUPAC name:	1,3-dimethylbenzene	1,3,5-trimethylbenzene	2-methylbenzoic acid	4-methylphenol

Nomenclature – Benzene as Substituents

- When the benzene ring is named as a **substituent** on another molecule, it is called a **phenyl group**. (often abbreviated **Ph**)

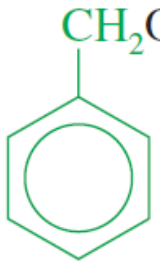


a phenyl group

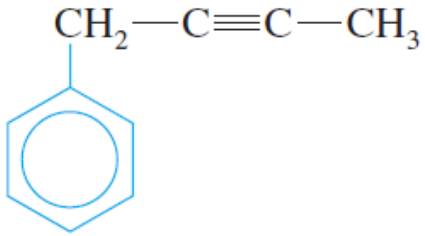


a benzyl group

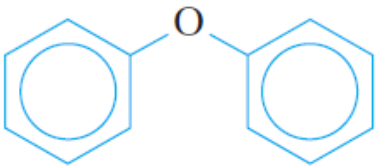
benzyl bromide
(α-bromotoluene)



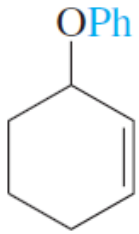
benzyl alcohol



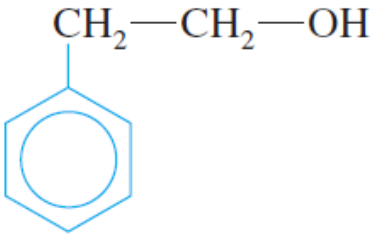
or Ph—CH_2—C≡C—CH_3
1-phenylbut-2-yne



or Ph_2O
diphenyl ether



3-phenoxycyclohexene

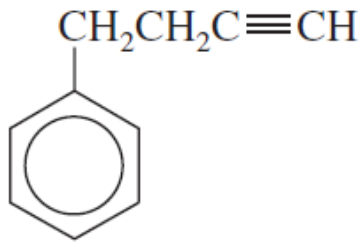


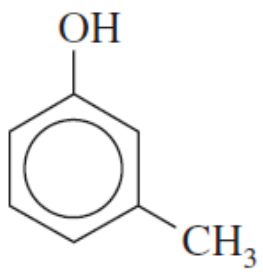
or $PhCH_2CH_2OH$
2-phenylethanol

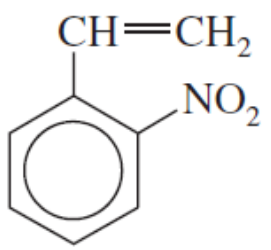
Problem #4

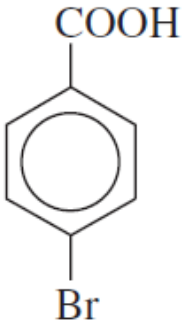
Name the following compounds:

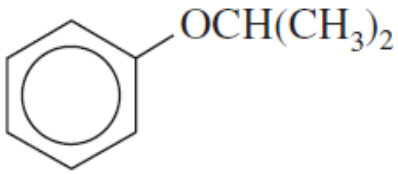
(a) 

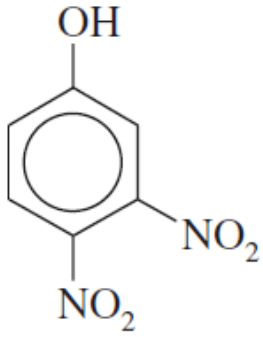
(b) 

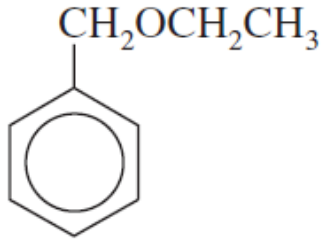
(c) 

(d) 

(e) 

(f) 

(g) 

(h) 

Physical Properties of Aromatic Compounds

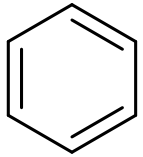
- **Density:** More dense than nonaromatics, less dense than water.

- **Solubility:** Generally **insoluble in water.**

- **Melting points**: More **symmetrical** than corresponding alkane, **pack better** into crystals, so **higher** melting points.

MP = - 95 ^{o}C

BP = 69 ^{o}C

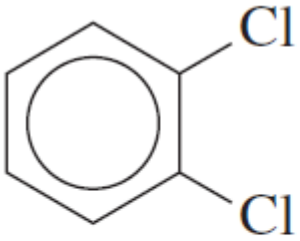


MP = 7 ^{o}C

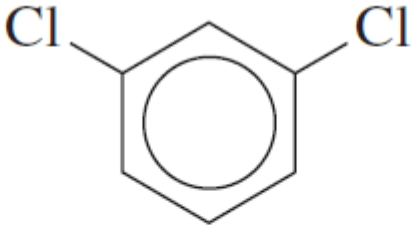
BP = 81 ^{o}C

Physical Properties of Aromatic Compounds

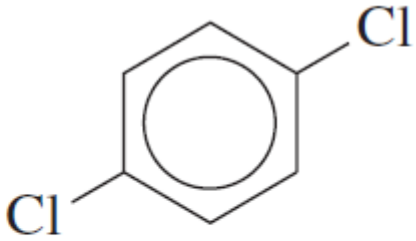
- **Boiling points: Intermolecular force**
  - **H-bonding** (functional groups on aromatic)
  - **Dipole-dipole** (dipole moment)
  - **London** (molecular weight)



o-dichlorobenzene
bp 181 °C
mp –17 °C



m-dichlorobenzene
bp 173 °C
mp –25 °C



p-dichlorobenzene
bp 170 °C
mp 54 °C

Physical Properties of Aromatic Compounds

TABLE 16-1 Physical Properties of Benzene Derivatives

Compound	mp (°C)	bp (°C)	Density (g/mL)
benzene	6	80	0.88
toluene	−95	111	0.87
ethylbenzene	−95	136	0.87
styrene	−31	146	0.91
ethynylbenzene	−45	142	0.93
fluorobenzene	−41	85	1.02
chlorobenzene	−46	132	1.11
bromobenzene	−31	156	1.49
iodobenzene	−31	188	1.83
nitrobenzene	6	211	1.20
phenol	43	182	1.07
anisole	37	156	0.98
benzoic acid	122	249	1.31
benzyl alcohol	−15	205	1.04
aniline	−6	186	1.02
o-xylene	−26	144	0.88
m-xylene	−48	139	0.86
p-xylene	13	138	0.86