CHEM 242 – Lecture 15 *12/02/2014*

Overheads: - Outline

Recap Friday:

Aromatic: extremely stable

1) Cyclic, planar, p orbital on each atom
2) odd number of electron pairs in the ring (= $4n+2\ \pi\ e^-$)

Antiaromatic: fits rule #1, but NOT rule #2 (ie even pairs)

** extremely unstable

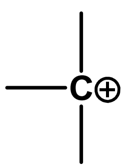
** If molecule can do anything (eg bend) to avoid being antiaromatic it will

Examples of Aromatics:

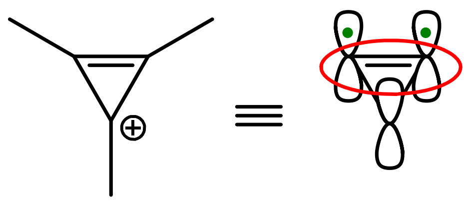
1) Fused rings: count double bonds in all rings (as long as p on each orbital etc)

2) O/N/S in ring: Count lone pairs only if in p orbital

3) Cyclic Ions:

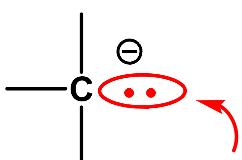


empty p



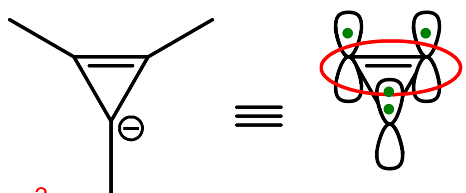
$2\ e^-$ in 3 p orbitals

1 pr ∴ aromatic



can be sp^2 or sp^3

- whichever is "better"



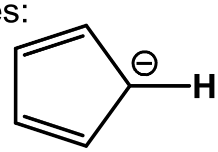
4 e- = 2 pairs = antiaromatic :-(

IF in p

∴ goes sp^3, no p

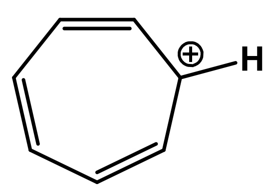
∴ neither aromatic nor anti

other examples:



cyclopentadienide: common ligand for metals

6 e- (2 C=C + -ive) ∴ aromatic

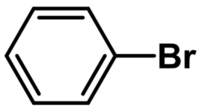


tropylium ion: most stable C+ known (aromatic)

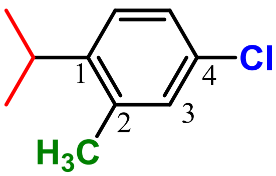
can buy $C_7H_7^+BF_4^-$ = only isolable C^+

Naming Aromatics

- most named as "substituents"benzene
- order and number as with cyclohexanes

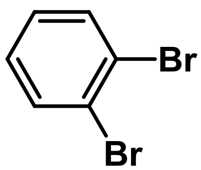


bromobenzene (don't number if only one group)

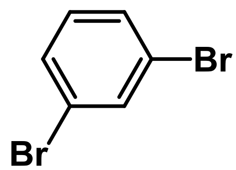


4-chloro-1-isopropyl-2-methylbenzene

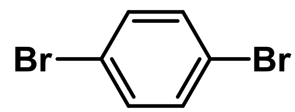
<u>Special:</u> for disubstituted <u>*only*</u> can use ortho, meta, para <u>*instead of numbers*</u>



ortho-dibromobenzene
or *o*-dibromo...

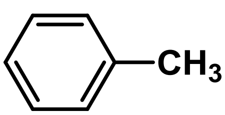


meta-dibromobenzene
or *m*-dibromo...

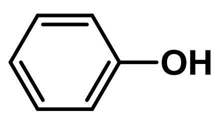


para-dibromobenzene
or *p*-dibromo...

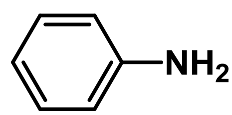
<u>Special Names:</u>



toluene



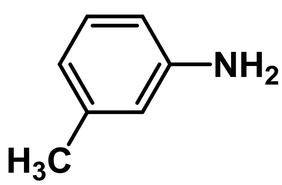
phenol



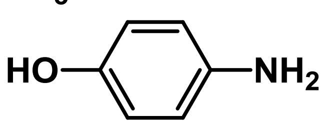
aniline

know these

<u>Examples:</u>



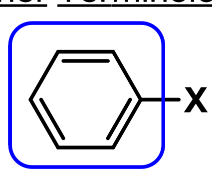
3-methylaniline (or meta...)



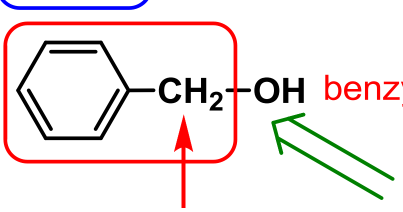
4-aminophenol (or para...)

OH > NH_2

<u>Other Terminology:</u>



phenyl group (=Ph) (Ar = genetic aryl)



benzyl group (=Bn)

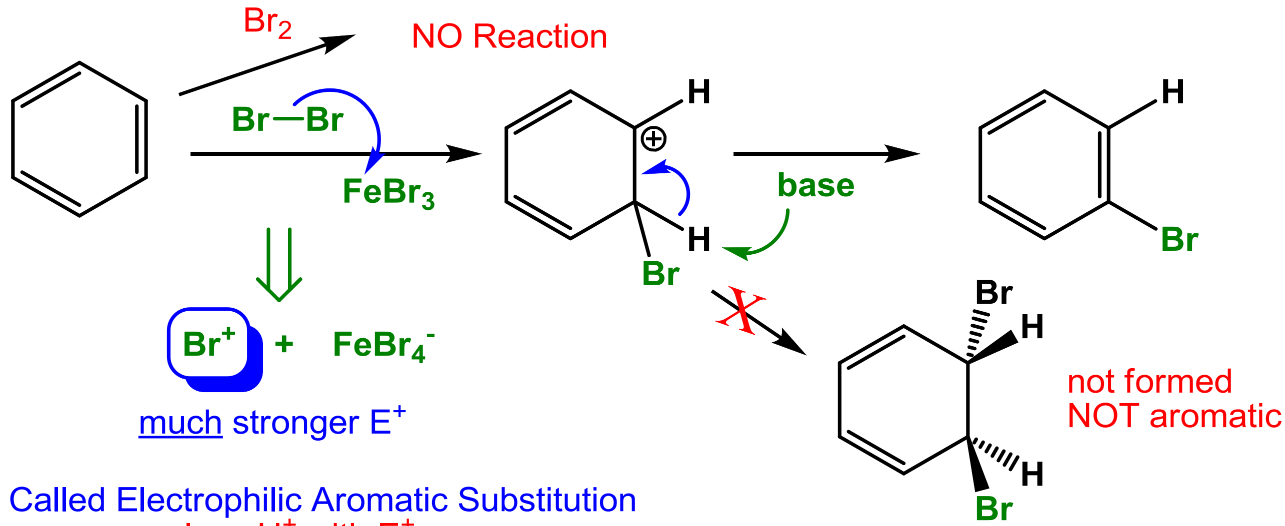
benzyl alcohol

benzylic C

Reactions of Benzene: same as C=C?

Because of stability, less reactive than “normal” C=C

- will not react with HBr, Br_2 etc
- need very strong E^+



⇒ Called Electrophilic Aromatic Substitution

- replace H^+ with E^+