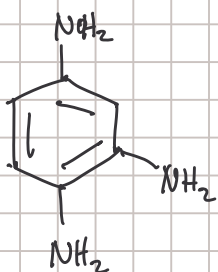


Homework 5 extra exam credit:

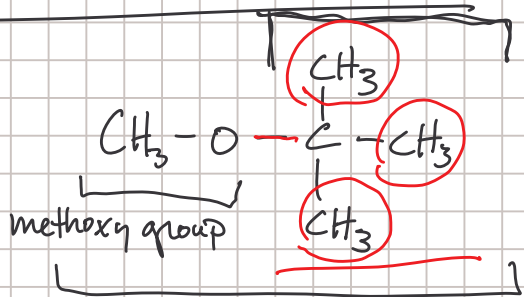
- up to +5 on exam: 4.7/s or higher
- +2 on exam: 4.5/s or higher
- +2 on exam: anything over s/s w/ extra credit.



achiral

σ
in paper

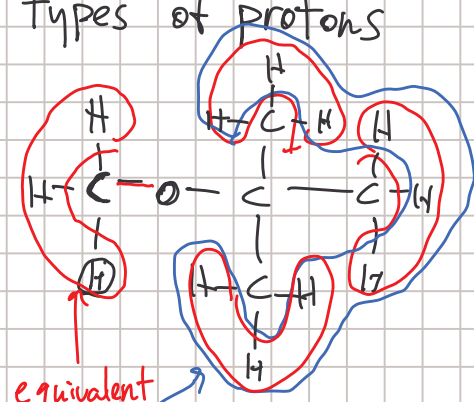
Chemical equivalence



3 methyl groups
are equivalent

so all 9

"types" of protons

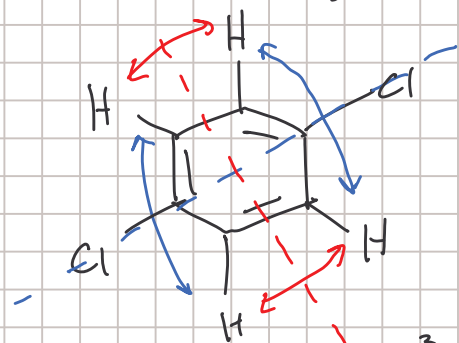
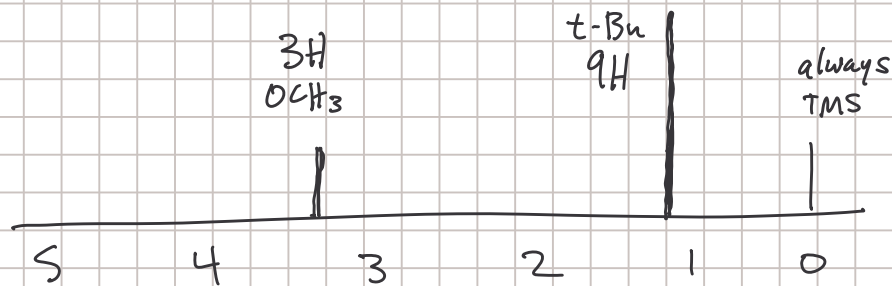


equivalent

are equivalent!

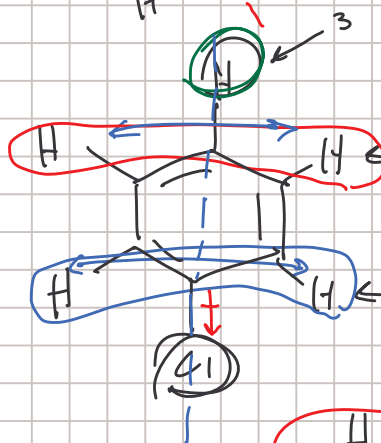
2 types of protons

- 3 methoxy protons δ 3-4 ppm
- 9 t-butyl protons δ ~1 ppm



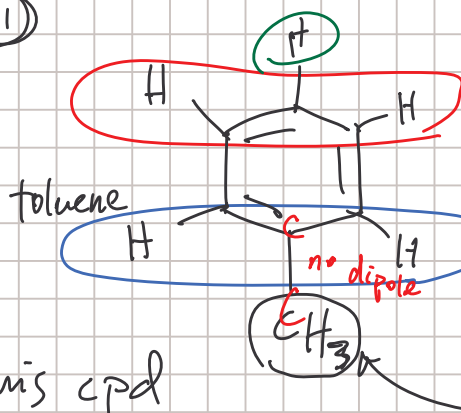
all 4 H's are equivalent!

- 1 resonance on NMR



3 types of H

3 resonances on NMR
3 different δ 's



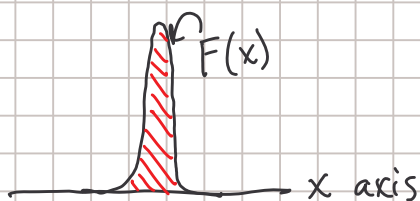
toluene
Still 3 types of aromatic H's
(4 total)

but in this cpd

all Ar-H's have same chemical shift

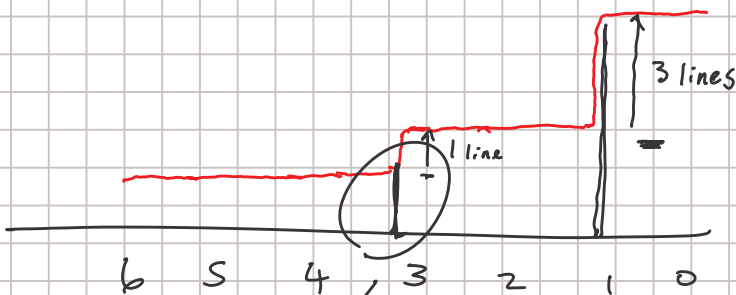
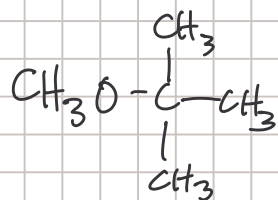
accidentally equivalent

Integration (peak area)



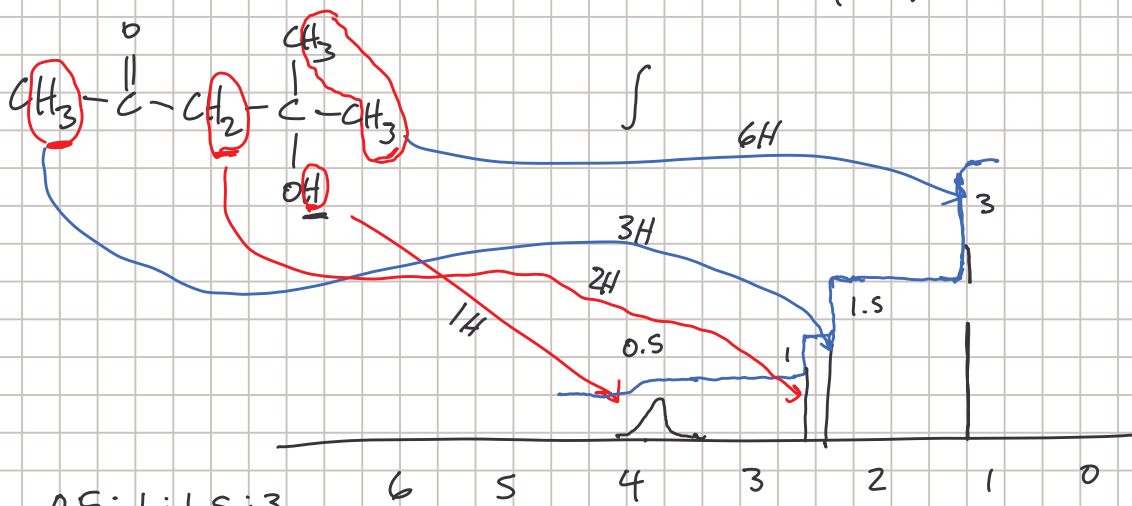
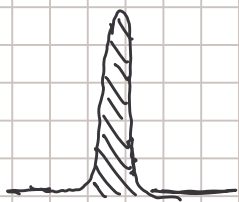
$$\int F(x) dx = \text{area under curve}$$

Area under peaks proportional to #H's in that resonance



1:3 ratio

2:6
3:9
4:12 etc



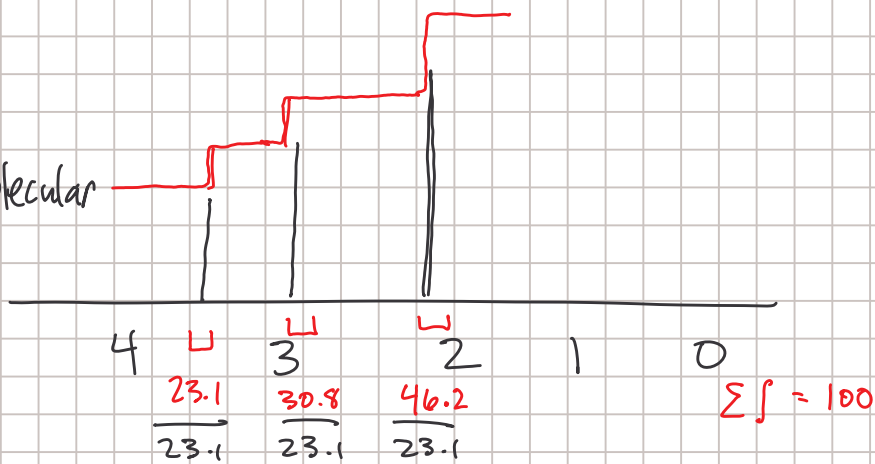
0.5:1:1.5:3
1:2:3:6

MS: M^+ 143 m/z 1 N present

IR: isolated $C=O$ at least 1 O present

NMR:

What is the molecular formula?



$$= 1 : 1.3 : 2$$

$$2 : 2.6 : 4$$

$$3 : 4 : 6$$

smallest whole-# ratio

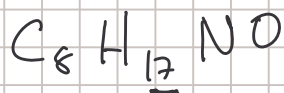
13 H total if this is correct

let's try $N \neq 10$

$$143 - 14 - 16 = \frac{113}{12} = 9.41 \quad \text{could have up to 9 C}$$

carbons
 $9 \times 12 = 108$ only 5 H's

carbons
 $8 \times 12 = 96$ 17 H's

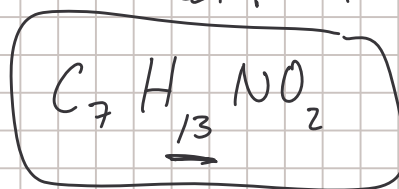


$$143 - 14 - 32 = 97$$

$$7C \times 12 = 84$$

$$\underline{13 H}$$

Correct formula



Spin-spin splitting tells how many H's are on adjacent carbon

