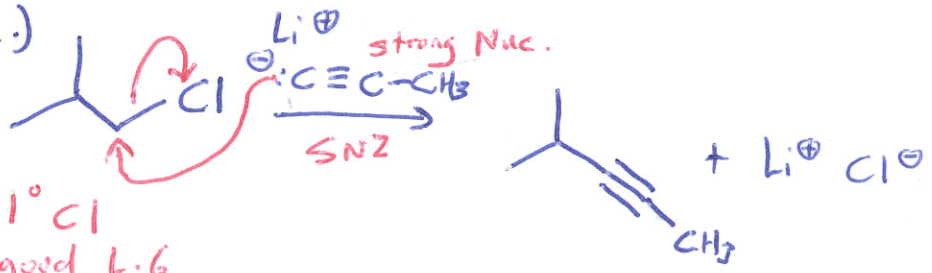
Spring/Summer 2013

CHM 2120 - Midterm Practice Questions

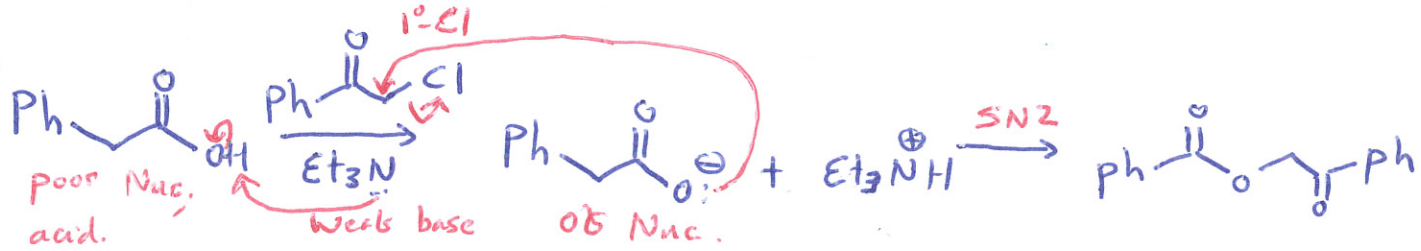
Answers

1.) a.)



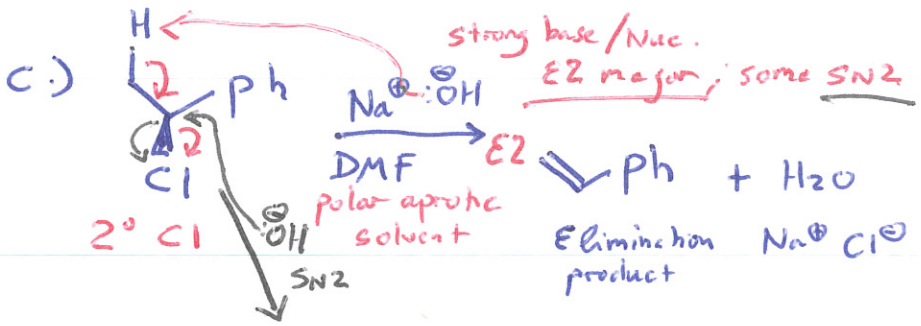
1° Cl
- good L.G

b.)

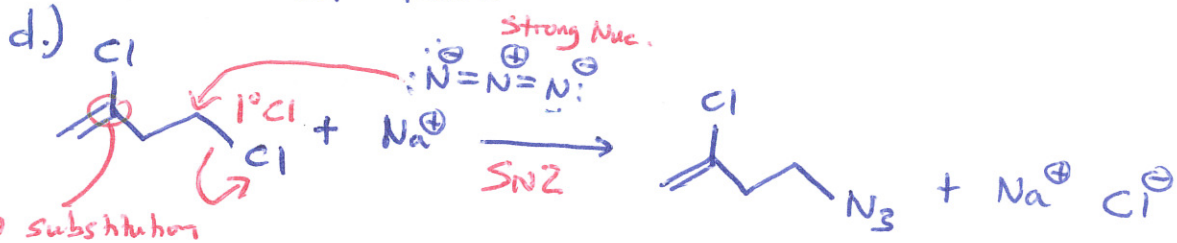


ob Nuc.

c.)



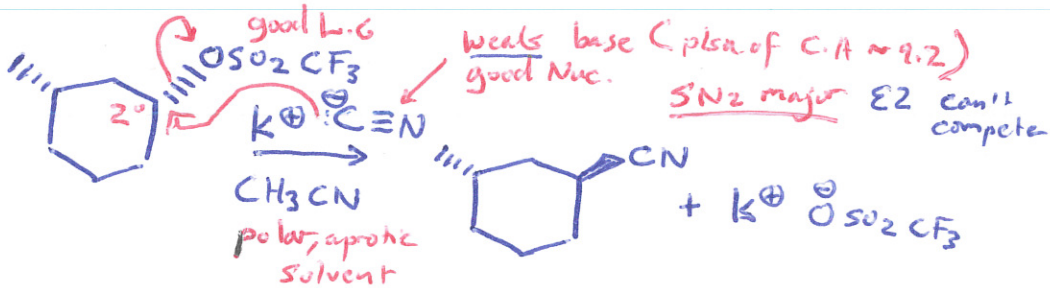
d.)



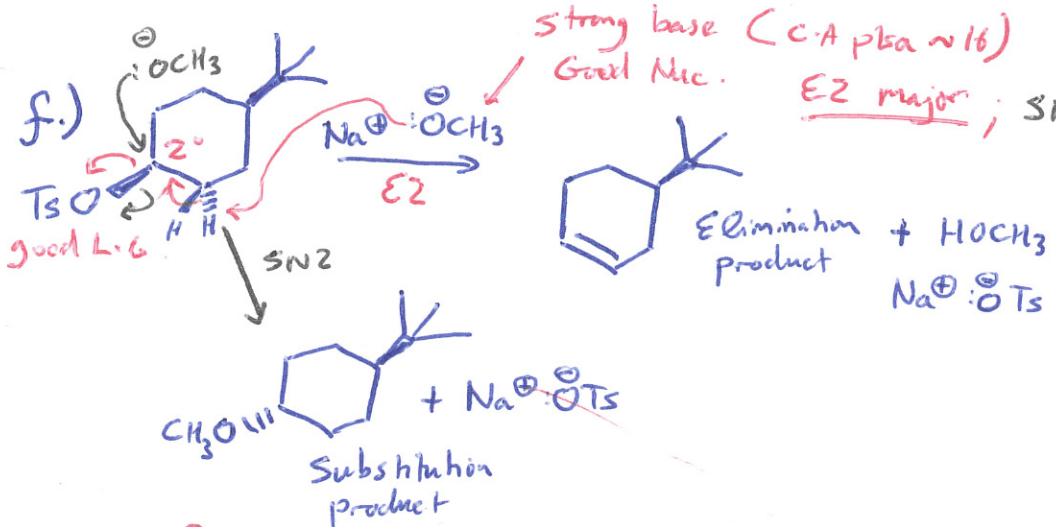
no substitution

(SN2) @ sp^2 C
- SN2 can only happen at sp^3 C

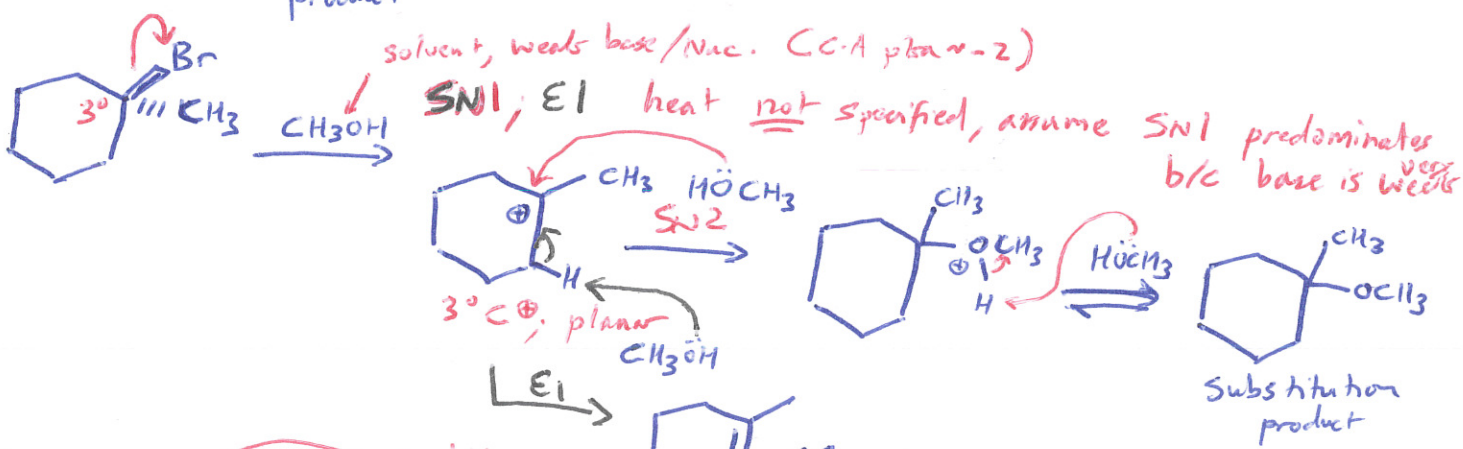
e.)



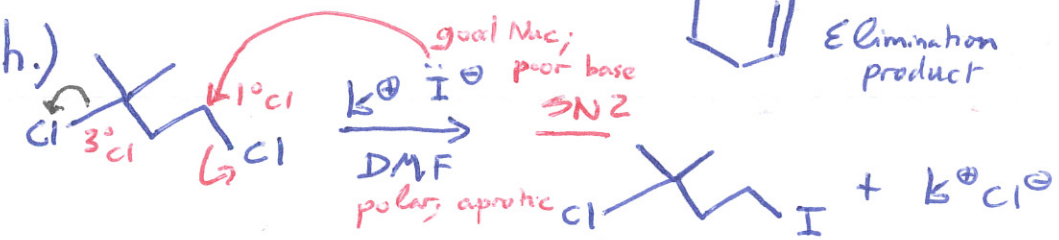
f.) strong base (C.A pka ~16) Good Nuc. E2 major; SN2 minor



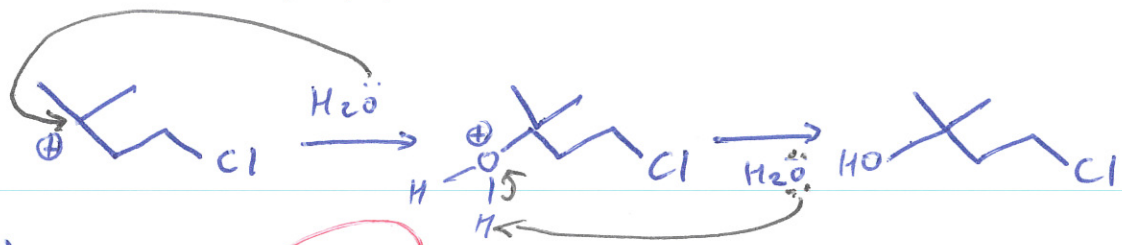
g.) solvent, weak base/Nuc. (C.A pka ~ -2)



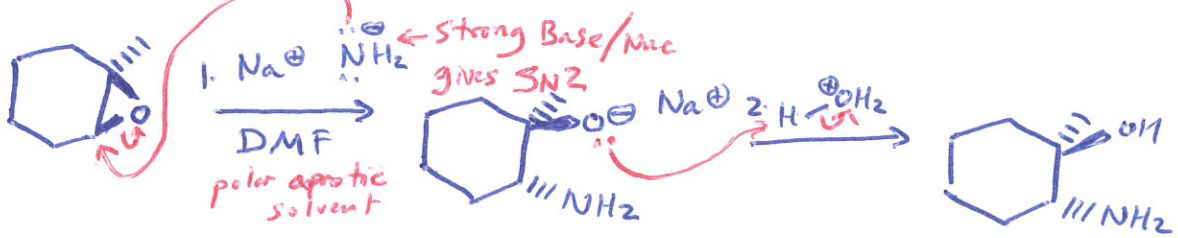
h.)



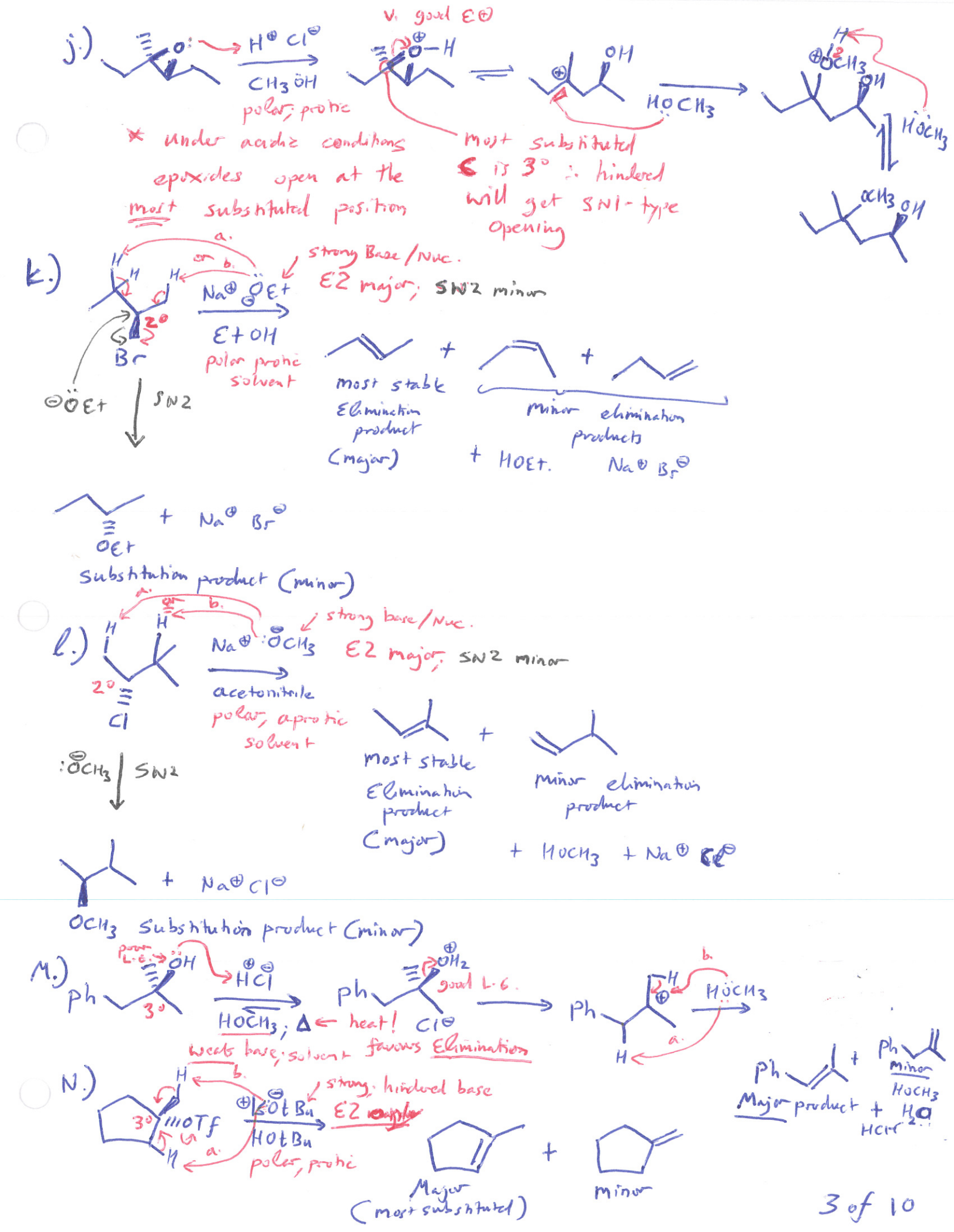
SN1 $H_2\ddot{O}$ polar, protic; Nuc.
acetone polar, aprotic



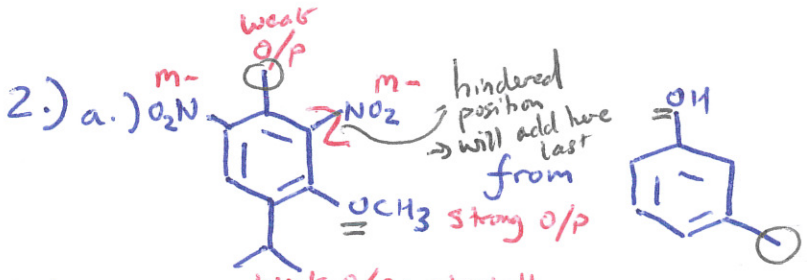
i.)



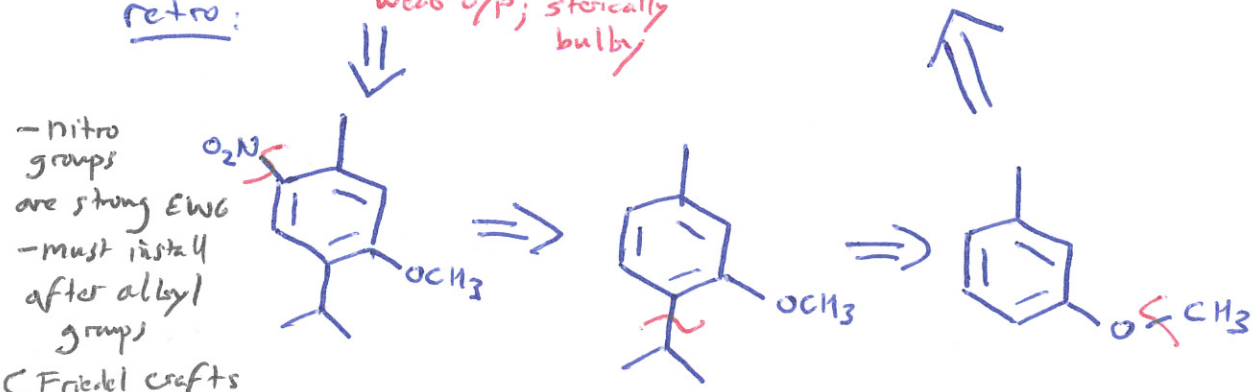
* under basic conditions epoxides open at least substituted position.


j.)
$H^{\oplus}$ $Cl^{\ominus}$
CH_3OH
polar, protic
v. good E⊖
$HOCH_3$
* under acidic conditions epoxides open at the most substituted position
most substituted C is 3° ∴ hindered will get SN1-type opening
k.)
a.
or b.
strong Base/Nuc.
$Na^{\oplus}$ $^{\ominus}OEt$
EtOH
polar protic solvent
E2 major; SN2 minor
2°
Br
$^{\ominus}OEt$
SN2
most stable Elimination product (major)
minor elimination products
+ HOEt.
$Na^{\oplus}$ $Br^{\ominus}$
OEt
+ $Na^{\oplus}$ $Br^{\ominus}$
Substitution product (minor)
l.)
a.
or
b.
strong base/Nuc.
$Na^{\oplus}$ $:OCH_3$
E2 major; SN2 minor
2°
Cl
acetonitrile
polar, aprotic solvent
$:OCH_3$
SN2
most stable Elimination product (major)
minor elimination product
+ $HOCH_3$ + $Na^{\oplus}$ $Cl^{\ominus}$
OCH_3 Substitution product (minor)
M.)
poor L.G.
HCl
good L.G.
Ph
3°
$HOCH_3$; Δ ← heat!
weak base; solvent favors Elimination
a.
b.
Major product
Minor
$HOCH_3$
+ H_2O
HCl
N.)
3°
OTf
a.
b.
strong, hindered base
$^{\ominus}OtBu$
E2 only
HOtBu
polar, protic
Major (most substituted)
minor

2.) a.)

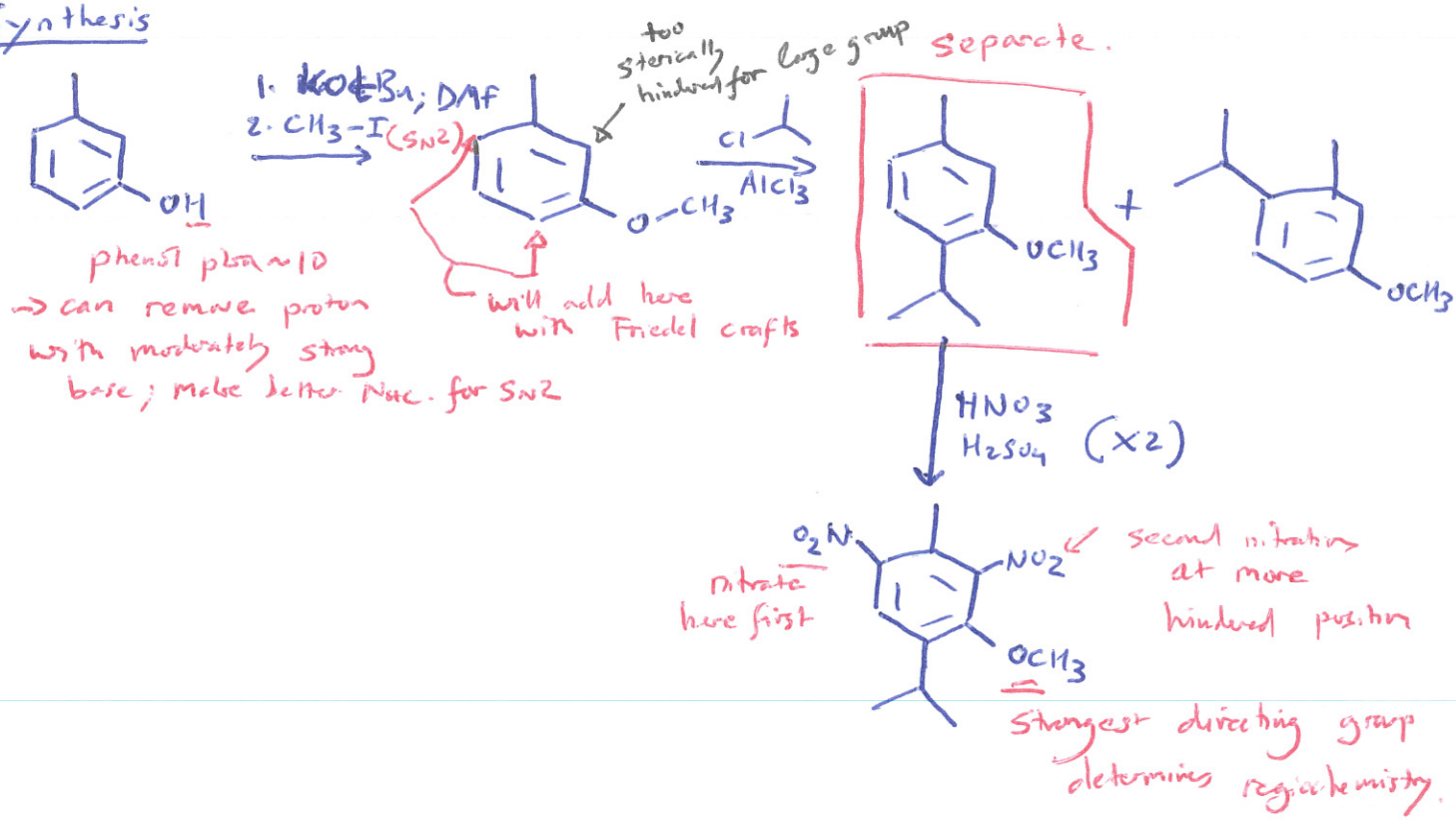


retro:



- nitro groups are strong EWG
- must install after alkyl groups (Friedel crafts doesn't work well on deactivated rings)

Synthesis



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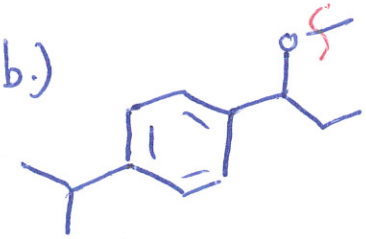
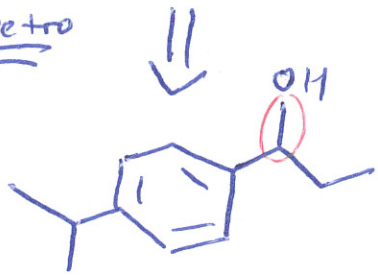
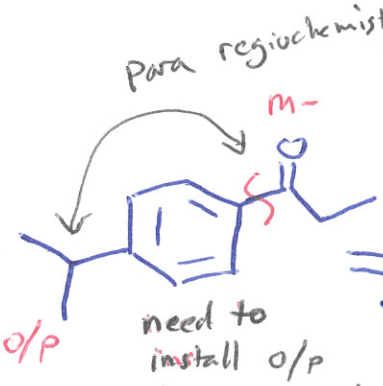


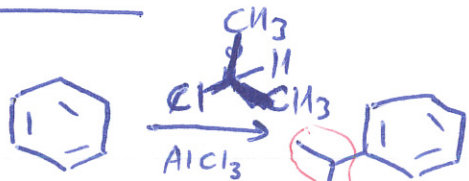
from

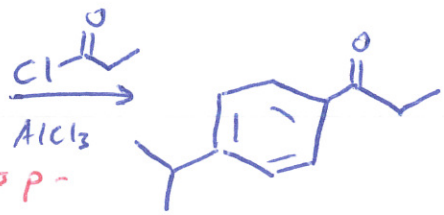
retro

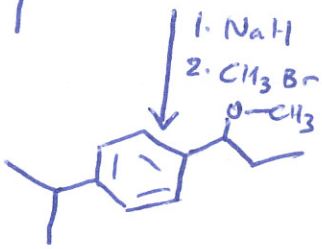




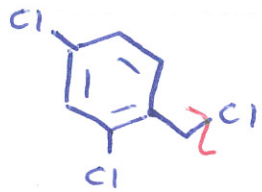
Synthesis





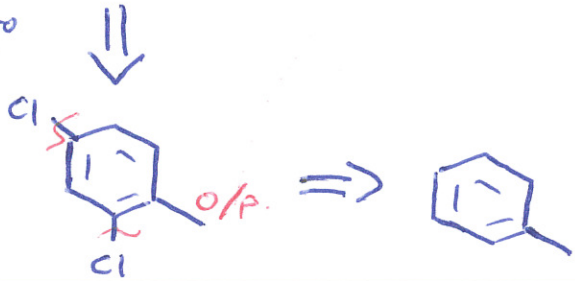


c.)

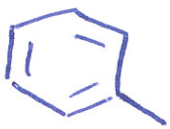


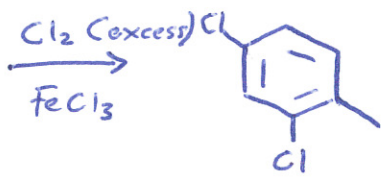
from

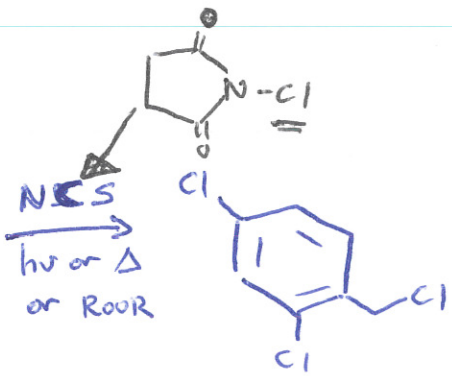
retro

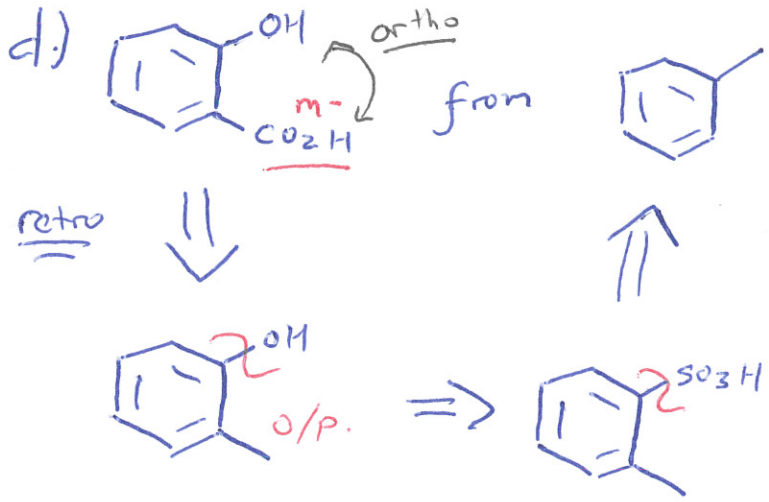


Synthesis







d.) 

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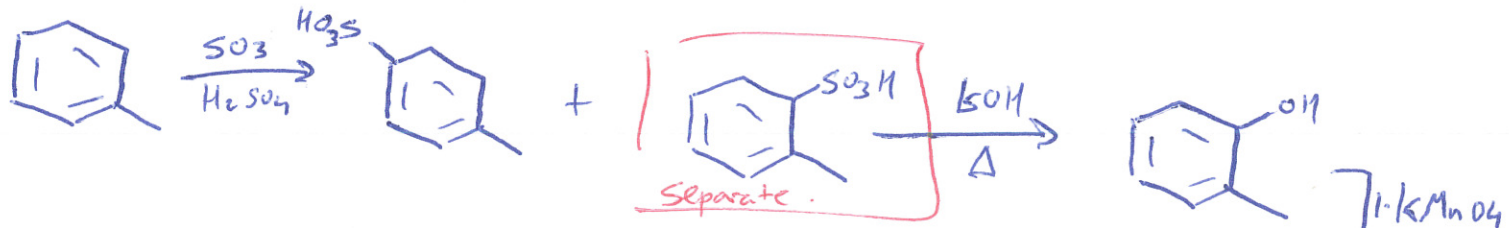
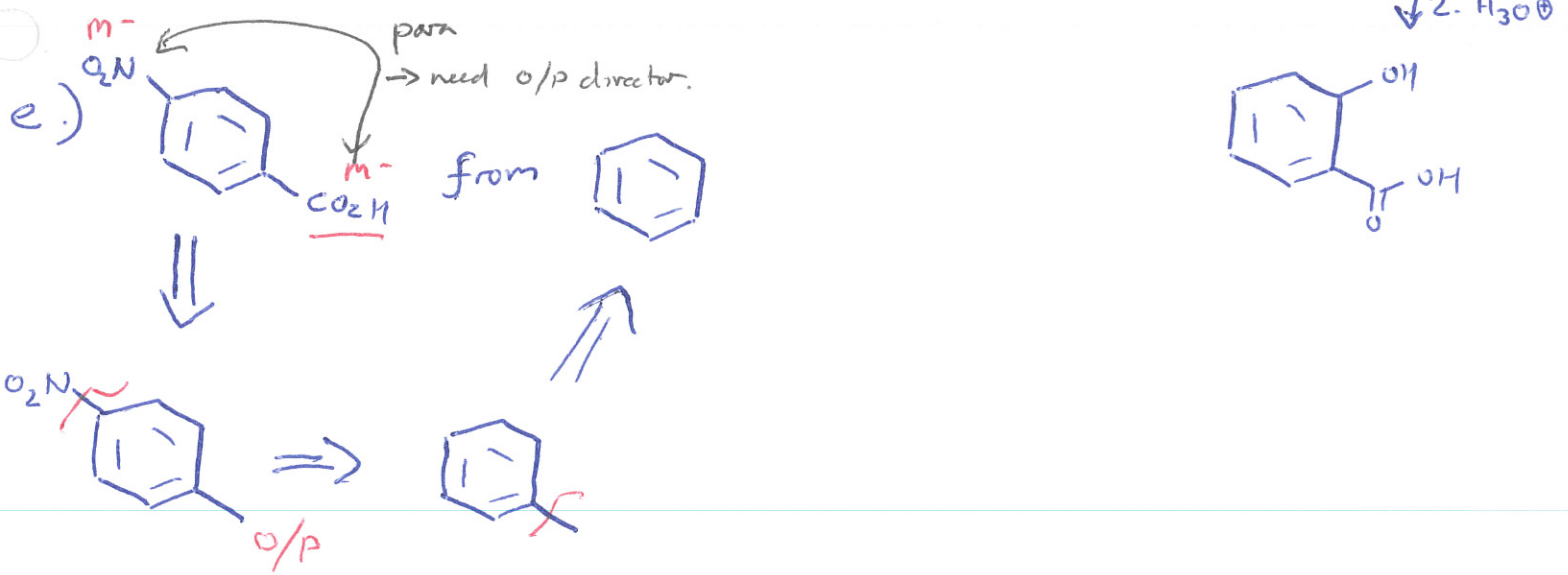
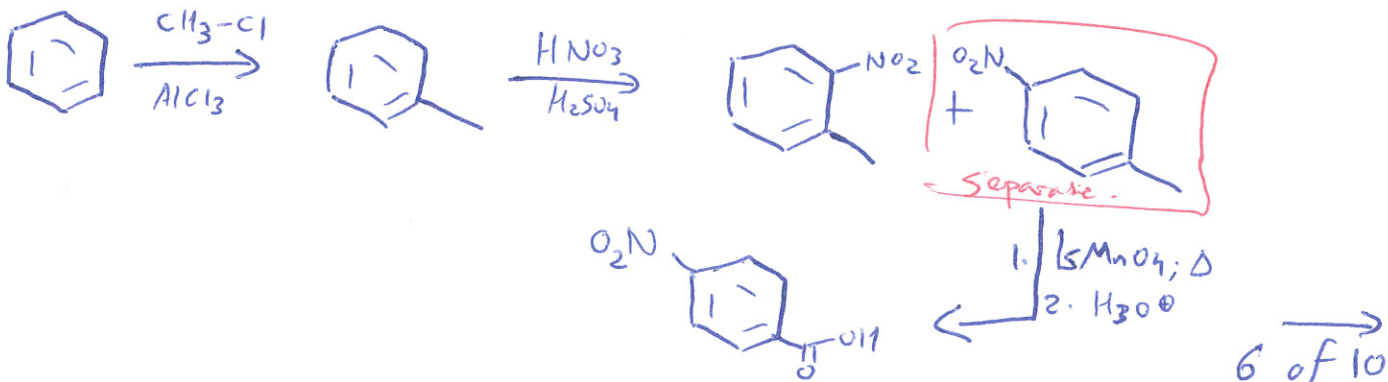
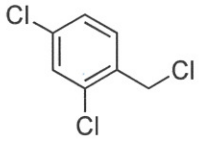
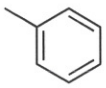
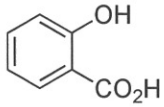
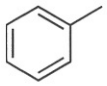


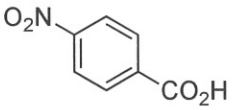


Synthesis



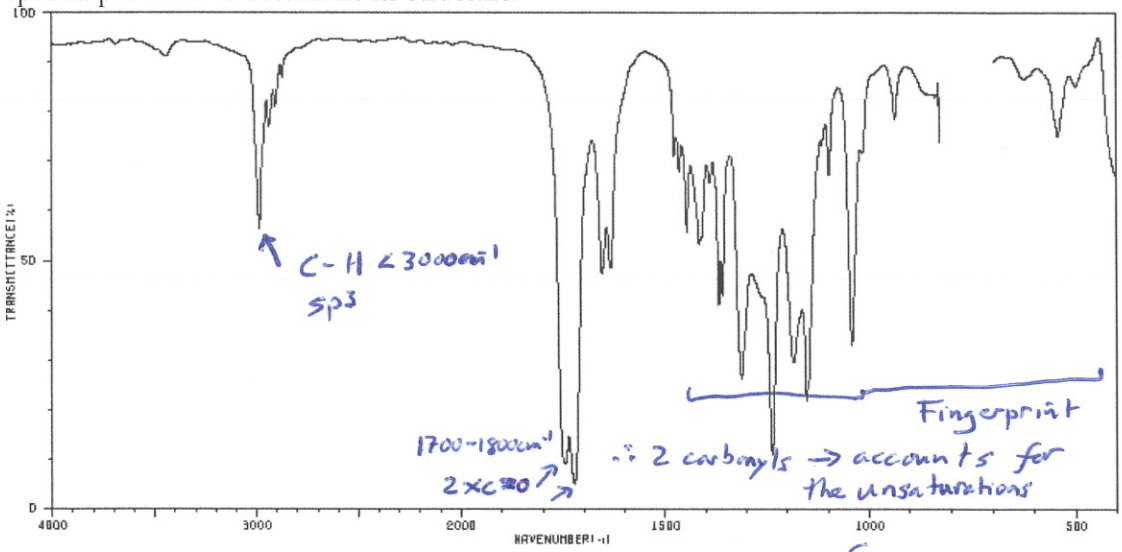
c)  from 

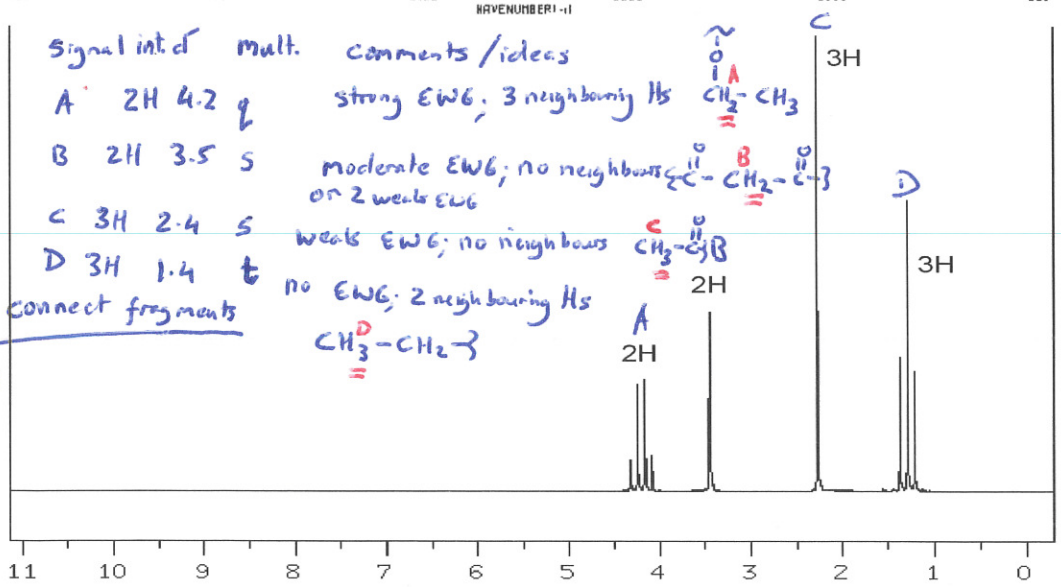
d)  from 

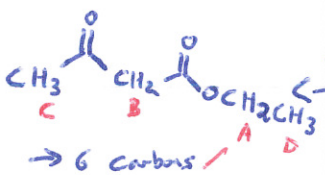
e)  from 

$DU = \frac{(2(6)+2-10)}{2} = \frac{4}{2} = 2$ double bonds / unsaturations

3. An unknown compound has the molecular formula $C_6H_{10}O_3$. Use the IR and NMR spectra provided to determine its structure.



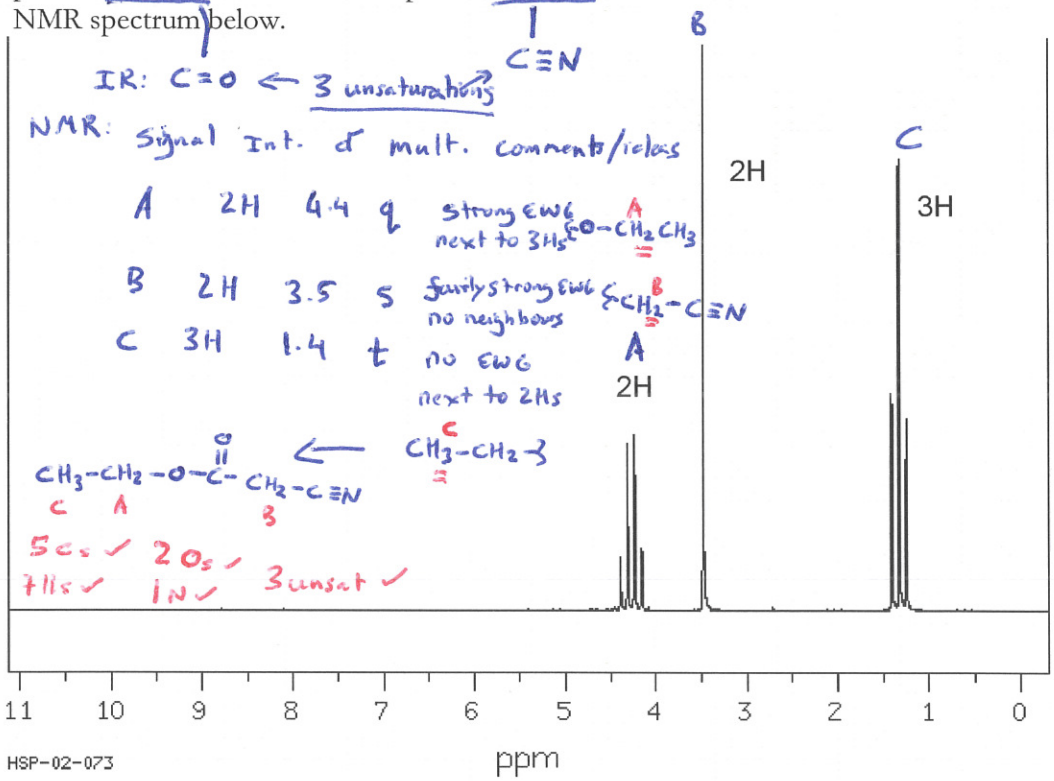




→ 6 carbons ✓
→ 10 Hs ✓
→ 3 Os ✓
→ 2 unsaturations. ✓

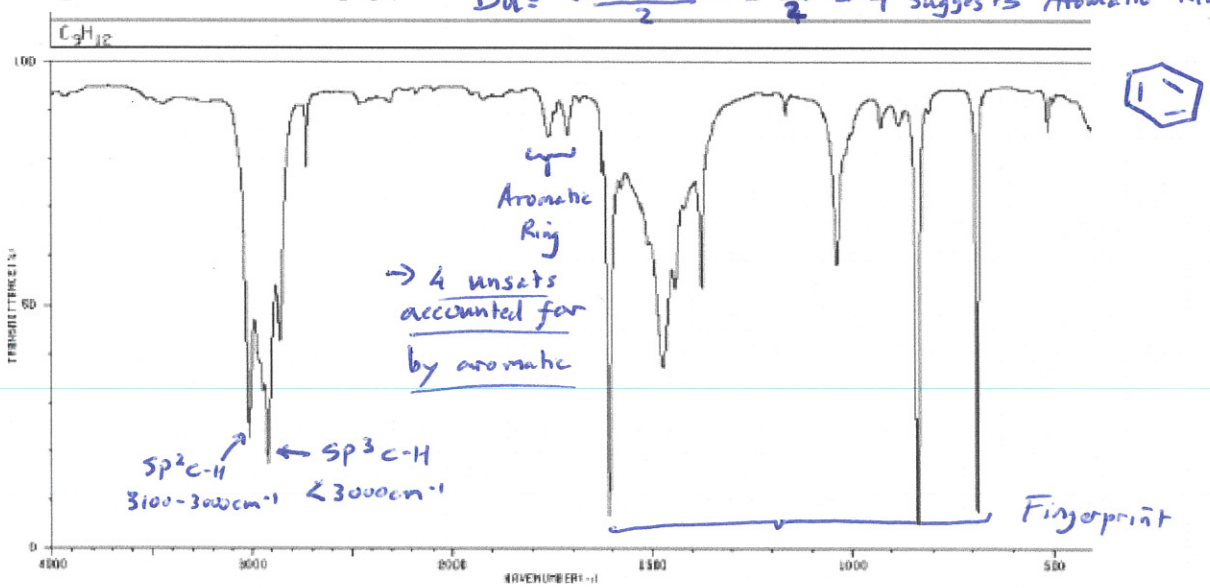
$DU = \frac{(2(5)+2-7+1)}{2} = \frac{6}{2} = 3$ double bonds/ unsaturations

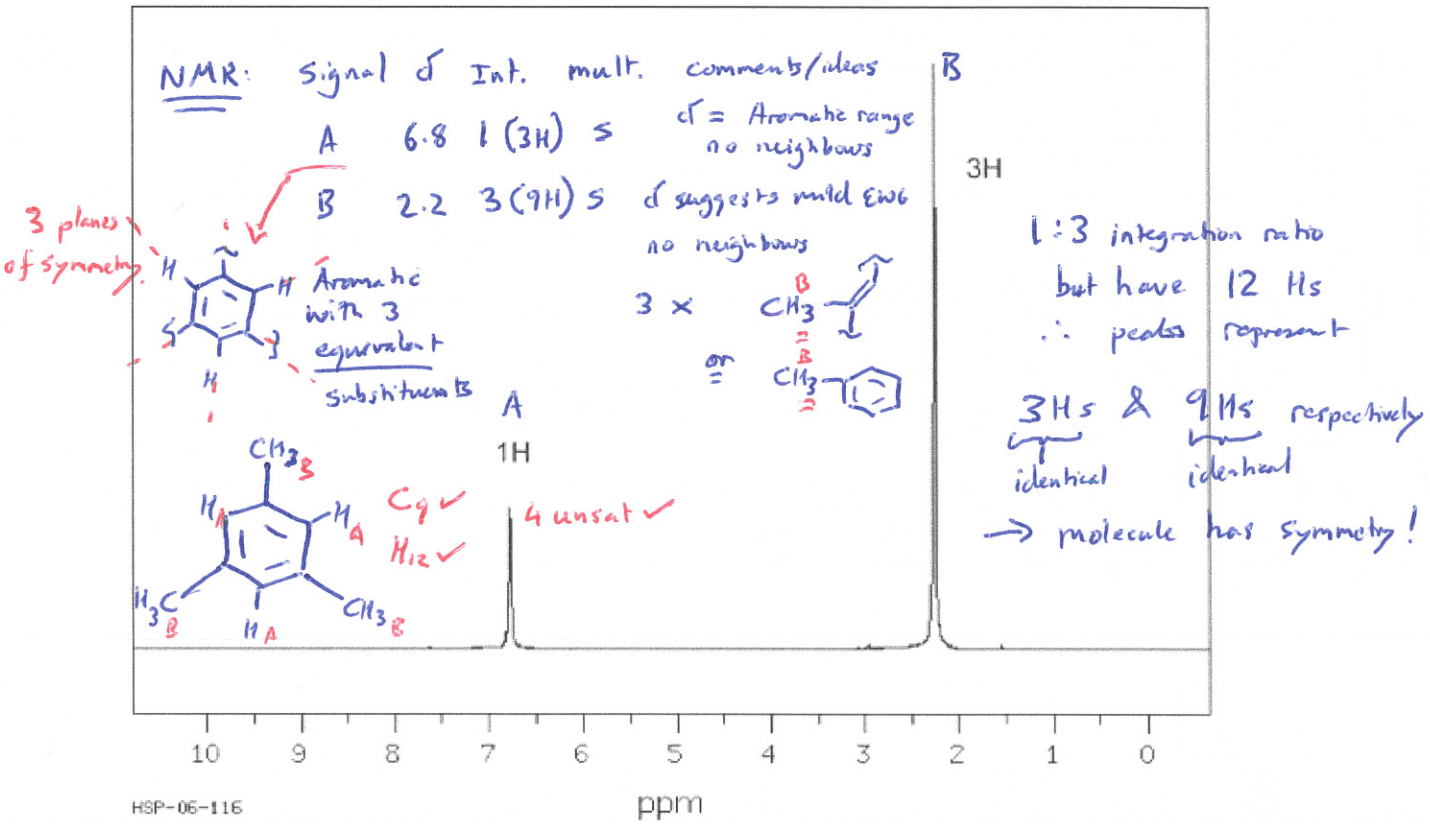
4. A compound with the molecular formula $C_5H_7NO_2$ has an IR spectrum with a strong peak at 1749 cm^{-1} and a medium peak at 2266 cm^{-1}. Elucidate its structure from the NMR spectrum below.



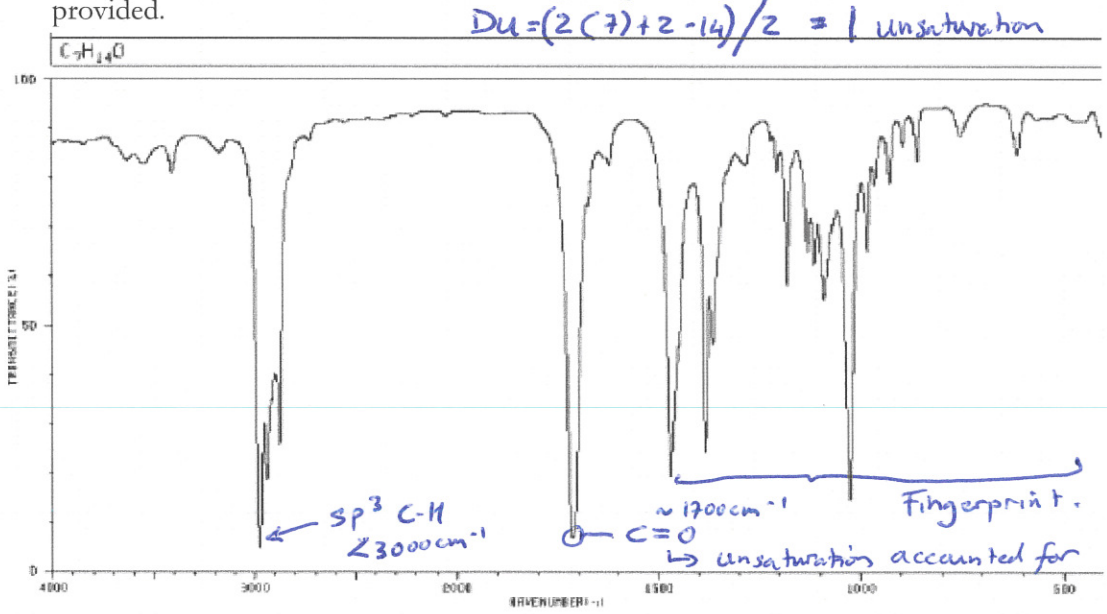
5. Suggest a structure for the unknown C_9H_{12} from the following information (the NMR spectrum is on the next page).

$DU = \frac{(2(9)+2-12)}{2} = \frac{8}{2} = 4$ suggests Aromatic Ring!

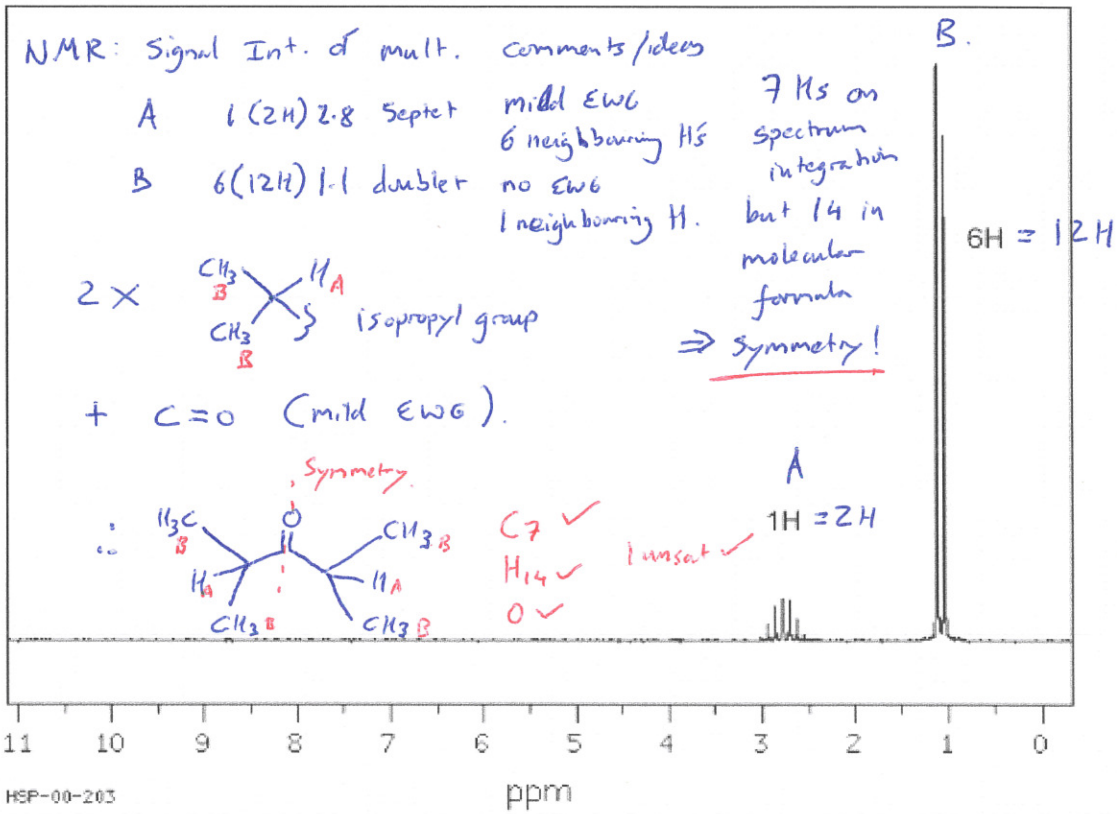




6. Elucidate the structure for the unknown $C_7H_{14}O$ from the IR and NMR spectra provided.



$C_7H_{14}O$


NMR: Signal Int. of mult. comments/ideas
A 1 (2H) 2.8 Septet mild EWG 6 neighbouring Hs
B 6 (12H) 1.1 doublet no EWG 1 neighbouring H.
7 Hs on spectrum integration but 14 in molecular formula
⇒ Symmetry!
2 × isopropyl group
+ C=O (mild EWG).
Symmetry.
C7 ✓
H14 ✓
O ✓
1unsat ✓
B.
6H = 12H
A
1H = 2H
11 10 9 8 7 6 5 4 3 2 1 0
HSP-00-203
ppm