PRINT FULL NAME: [redacted]

FIRST [redacted] LAST (FAMILY NAME) [redacted]

STUDENT# [redacted] Practical # P00 06

CHMB42 MIDTERM EXAM Wed March 9th 5-7 pm

TIME ALLOWED- 100 minutes

CLEARLY write answers in spaces provided. There are _2_ blank pages at the end of the exam for rough work.

Exams must be written in pen for any remarking claims. (NO PENCIL)

No models, 'white out', pagers or cell phones allowed.

Calculators are allowed.

This exam contains 8 pages including this page + 2 blank pages

Page 2 8 /10

Page 3 6 /8

Page 4 8.5 /12 +1

Page 5 15.5 /18 ~~20~~ +1

Page 6 18 /22 ~~18~~

Page 7 20 /20 ~~22~~.

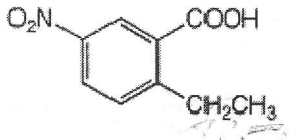
Page 8 10 /10

Bonus — /5

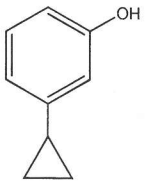
Total 86 /100
+2
88

Great job!

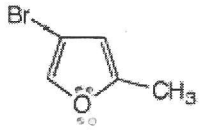
1. **(10 points) Write the IUPAC names for the following:**

a) 

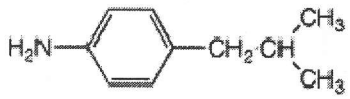
2-Ethyl-5-Nitro benzoic acid

b) 

3-cyclopropyl-phenol ✓

c) 

4-bromo-2-methyl-furan ✓

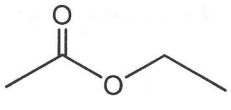
d) 

isobutyl

~~p-isob~~

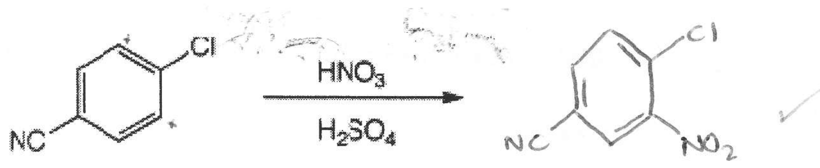
p-secbutyl-nitrobenzene

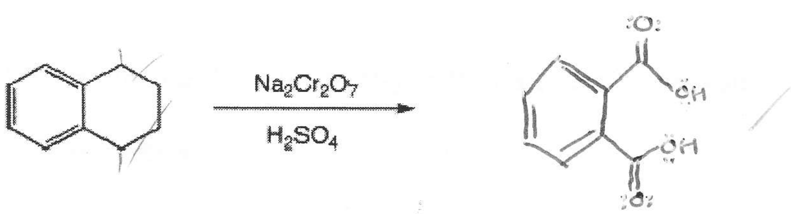
or 4-secbutyl-nitrobenzene

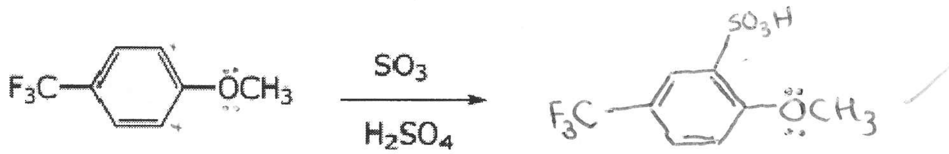
e) 

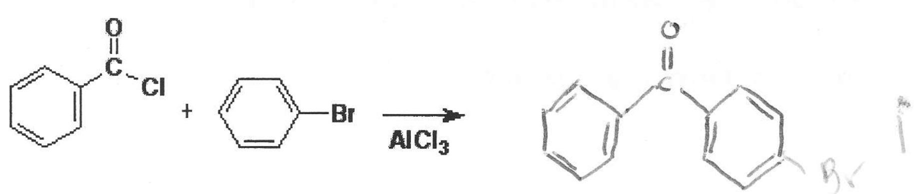
Ethyl ethanoate ✓

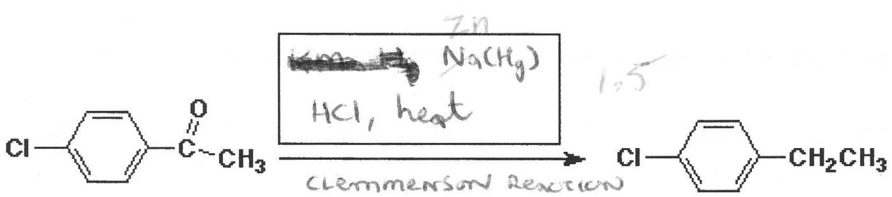
3. (12 points) Complete each of the following reactions by adding the missing part: either the starting compound, the necessary reagents and conditions, or the expected major product.

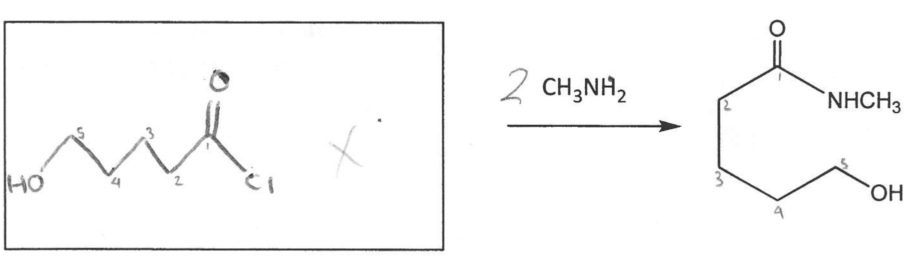


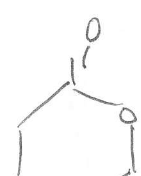












4. **(20 points) Identify the unknown compound based on the following information. For each piece of information, indicate what you conclude about the structure.**

What does it mean if:

IR has no absorptions in the range 3000 - 4000 cm-1 NOT ALCOHOL, NOT CARBOXYLIC ACID

IR has no absorptions in the range 1600 - 2800 cm-1 NOT A KETONE, NOT CYCLIC

MUST BE AN ETHER !

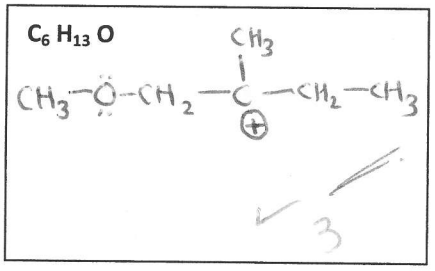
MS - molecular formula $C_6H_{13}BrO$, major fragment appears at (m/z) 101, what is lost?

~~OXYGEN~~ BROMINE

180 - 79 = 101

UN = 0

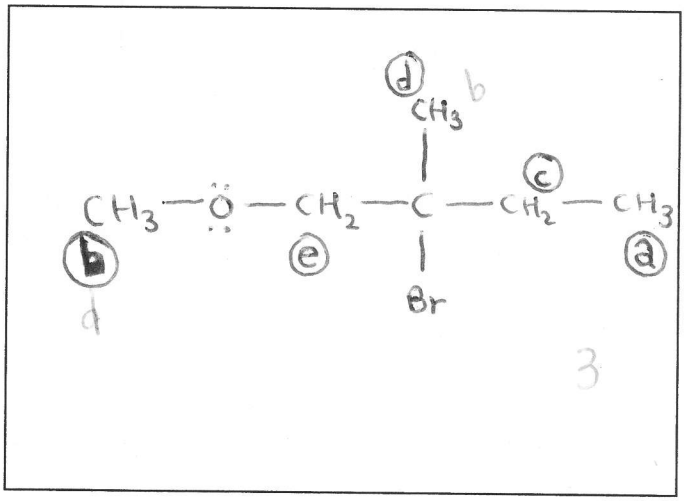
$C_6H_{13}O$ - compound with Br removed –draw the structure and show correct charge



Draw the structure of the original $C_6H_{13}BrO$ in the box on the bottom right.

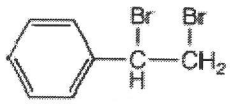
Using the ^{1}H NMR data below: label your structures' protons with a,b,c, etc.

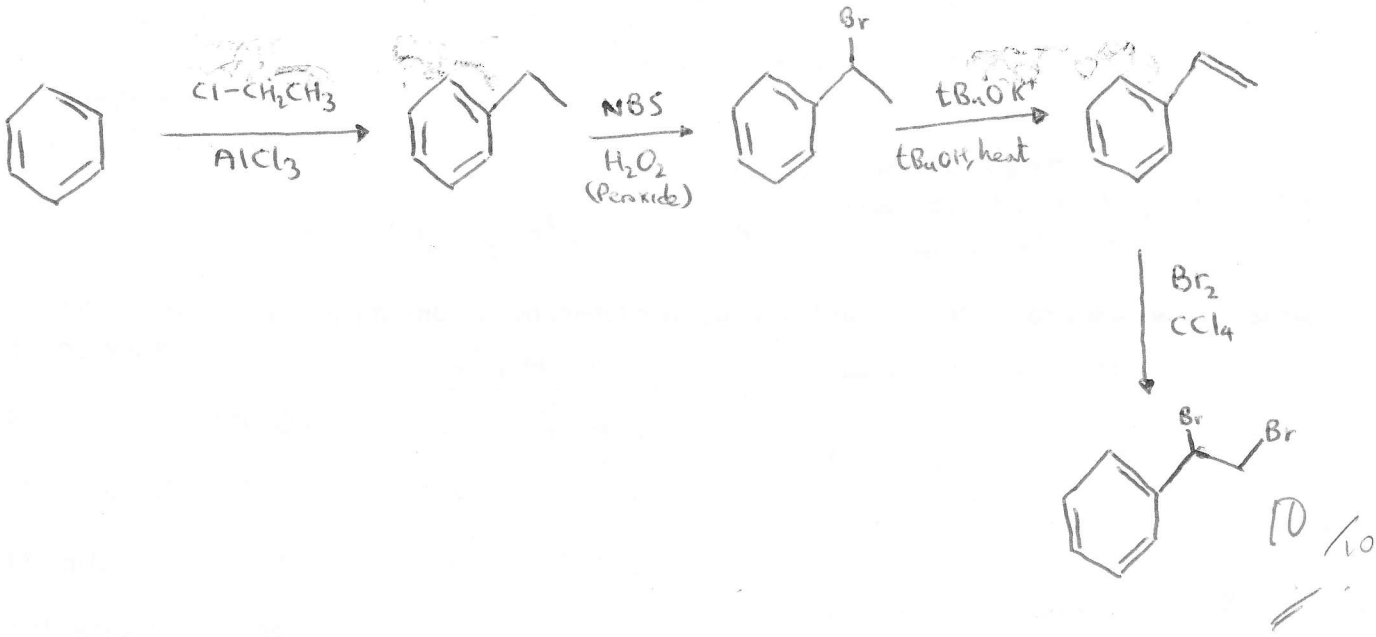
- **a - 1.1 ppm, 3H, triplet**
- **b - 1.7 ppm, 3H, singlet**
- **c - 1.9 ppm, 2H, quartet**
- **d - 3.3 ppm, 3H, singlet**
- **e - 3.9 ppm, 2H, singlet**



15.5/20

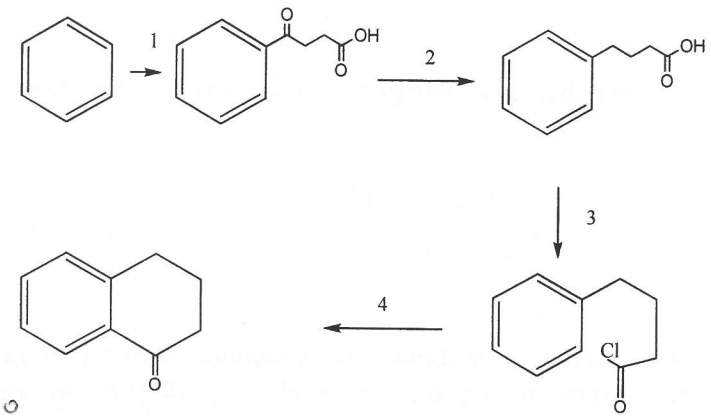
5. (10 points) Write a synthetic sequence of reactions that could be used to prepare the following compounds, starting from benzene and any organic or inorganic reagents.



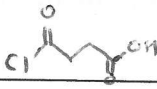


10 /10

6. (8 points)The synthesis of a six membered cyclic ketone onto an existing aromatic ring is a standard synthetic sequence. Specify the reagents necessary for each step:



8 /8

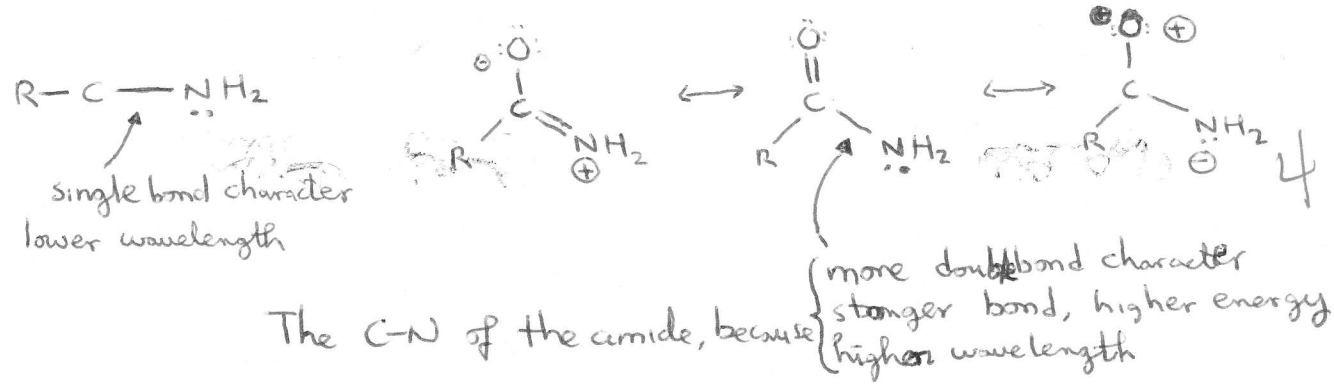
1.  , $AlCl_3$

2. ~~$NaCH_3$, HCl, heat (Clemmensen)~~ { H_2NNH_2, ^-OH, heat Wolff Kishner Reaction

3. $SOCl_2$

4. $AlCl_3$

7. (4 points) Which will occur at higher wavenumber, the C-N stretch of an amine or the C-N stretch of an amide?
Show the structure for each and any resonance structures, if applicable. Use a minimum number of words.



single bond character
lower wavelength

The C-N of the amide, because { more double bond character / stronger bond, higher energy / higher wavelength

4

8. (4) Calculate the molecular formula given the following data. Calculate unsaturation values as well. Show all your work.

Ion	intensity
$M^{+\cdot}$ m/z = 82	33
M^{+} m/z = 83	1.84
M^{+2} m/z = 84	.06

Make M! be 100%

33 $\xrightarrow{\times \frac{100}{33}}$ 100

1.84 $\xrightarrow{\times \frac{100}{33}}$ 5.58

0.06 $\xrightarrow{\times \frac{100}{33}}$ 0.18

M! even → NO Nitrogen

C = $\frac{5.58}{1.11}$ = 5 Carbons

$\frac{M!+1}{M!}$ = 0.18 < 1% → OXYGEN

H = 82 − [(12×5)+(16)] = 82 − 76 = 6 Hs

Formula C_5H_6O

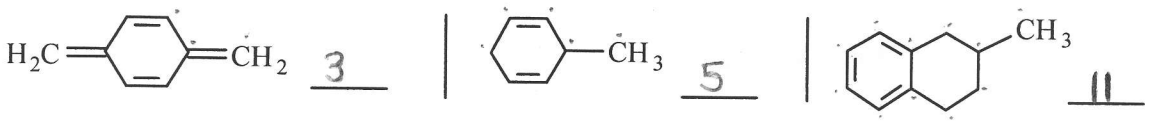
UN = [2+(2×C)+N−H−X]/2

= [2+(2×5)−6]/2 = 6/2 = 3

UN # 3

4

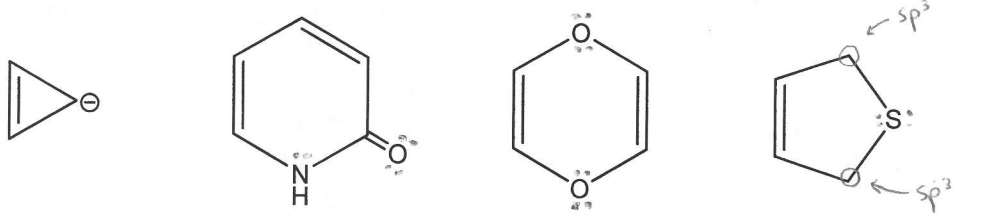
9. (6 points) Indicate the number of signals expected in the C-13 NMR spectrum of each of the following:



3 | 5 | 11

6

10. (8 points) For the following compounds state whether they are aromatic (A), nonaromatic, (N) or antiaromatic, (AA). Also clearly show the unpaired electrons on the atoms.

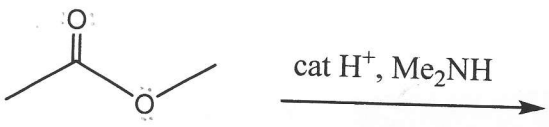


AA | A | AA | N

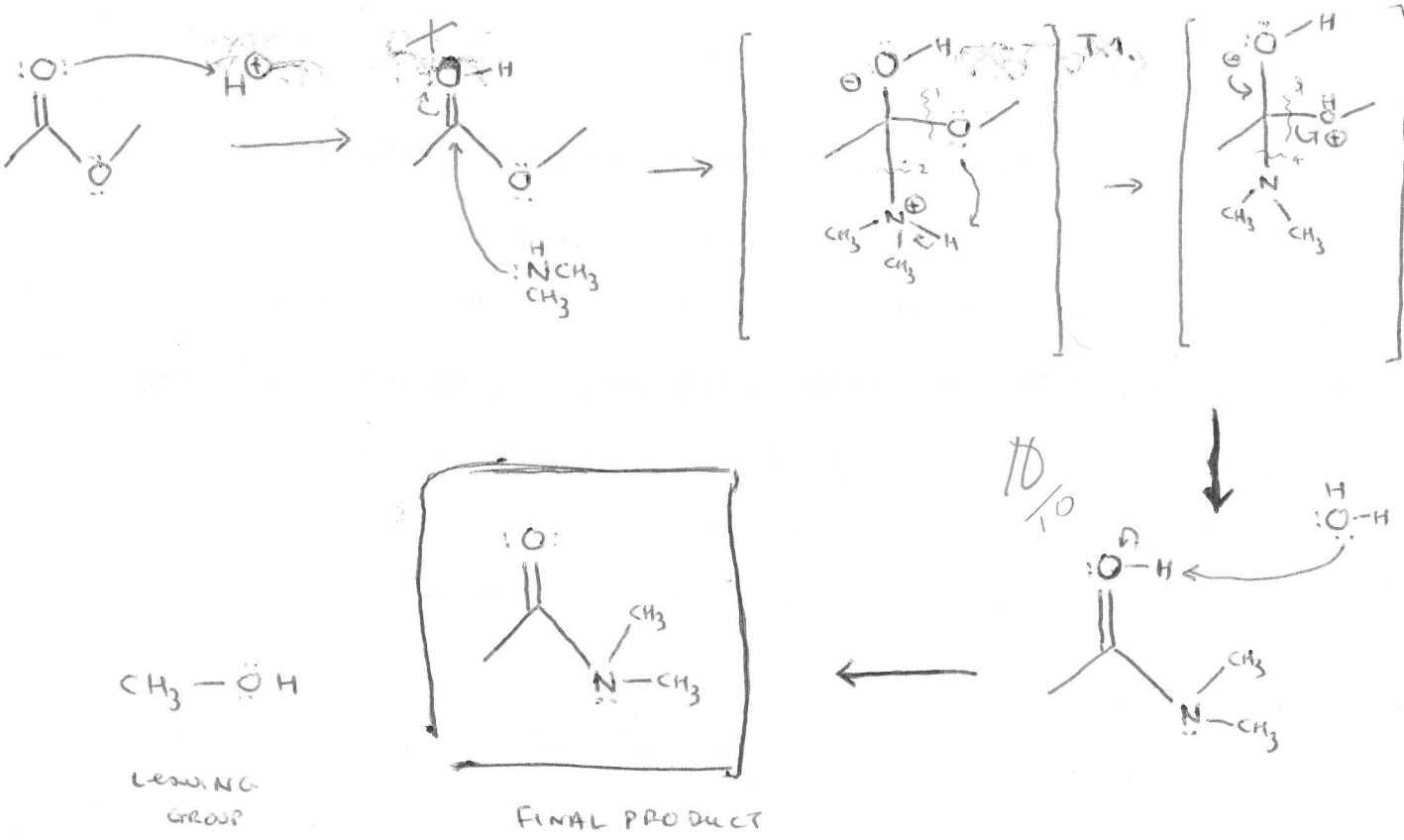
6/8

20/25

11. (10 points) Clearly draw products and the stepwise mechanism for the following reaction:



1) $^{\ominus}OCH_3$
2) $NH(CH_3)_2$ BETTER LG
3) $HOCH_3$
4) $^{-}NH(CH_3)_2$



LEAVING GROUP

FINAL PRODUCT

1) $^{\ominus}OCH_3$ → $HOCH_3$ BETTER LG

2) $NH(CH_3)_2$ GOOD LG → $^{\ominus}NH(CH_3)_2$

BONUS QUESTION

2-330

(5 points) From the following molecular formula and NMR spectrum, draw the structure of the molecule and pay particular attention to any stereochemistry. The answer will not be given any part marks, it **must be correct in all ways for credit**. $C_6H_{10}O_2$;

^{1}H NMR

a δ = 6.95 (dq, J = 16, 1H),
b δ = 5.81 (dq, J = 16, 1H),
c δ = 4.13 (q, J = 7, 2H),
d δ = 1.88 (dd, J = 6.8, 3H),
e δ = 1.24 (t, J = 7, 3H),