Name

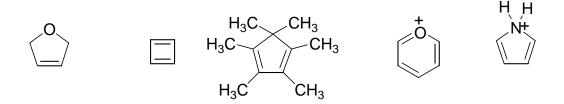
Good luck all round!

1) Identify the class of compounds each of the following molecules belong to (15pts).

$$R-CN$$

- 2) For each of the **amides** and **amines** state whether they are primary, secondary or tertiary (4pts).
- 3) Circle one of the above compounds that is reactive enough to react with neutral water (2pts).
- 4) Give two characteristic physical or chemical properties of **aromatic** compounds (4pts).

5) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (15pts)



$$S$$
 $N=$
 NO_2
 NO_2
 NO_2

6) Pick one of the above <u>antiaromatic</u> molecules, and use the polygon rule to demonstrate its <u>antiaromaticity</u>. (8pts)

7) Give the products in <u>six</u> of the following reactions, paying attention to regio/stereochemistry where applicable. (18pts)

NC——CN
$$\xrightarrow{\text{heat}}$$

$$O-\text{CH}_2\text{CH}_2\text{CH}_3 \xrightarrow{\text{Excess HBr}}$$

8) The below heterocycle contains two Nitrogen atoms, and is 6π Hückel aromatic.

The lone pairs on the two Nitrogens play different roles in the aromaticity of the molecule, and consequently one Nitrogen will get protonated before the other.

Describe which one gets protonated first, and explain their differing basicity. (10pts)

9) Give reagents and conditions to accomplish <u>five</u> of the following transformations. (15pts)

$$CH_3$$
 CH_5

$$O_2N$$
 O_2N
 O_2N

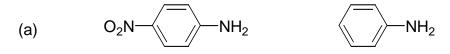
$$CH_2CH_3$$
 CO_2H
 CH_3CH_2
 CH_2CH_3
 CO_2H
 CO_2H
 CO_2H
 CO_2H

10) The addition of (1 equivalent of) HBr to *cis*-1,2-dimethyl-3,5-cyclohexadiene generates a mixture of products.

$$H_3C$$
 \longrightarrow HBr \longrightarrow mixture

Draw the products, predict their approximate ratio, and mechanistically account for the mixture of products. (10pts)

11) Circle the stronger base in the following pairs, and in a sentence explain your choice. (6pts)



(b)
$$F_3C-N$$
 C CH_3 H_3C-N C CF_3

12) Circle the stronger acid in the following pairs, and in a sentence explain your answer. (12pts)

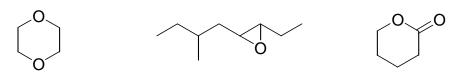
(a)
$$H_3C-\overset{II}{C}-OH$$
 CF_3CH_2-OH

(b)
$$CO_2H$$
 CO_2H CO_2H

(c)
$$Cl_3C-C-OH$$
 $Br_3C-C-OH$

O O
$$H-C-OH$$
 $H_3C-C-OH$

13) Name <u>five</u> of the following compounds in IUPAC acceptable terms. (15pts)



Rank **methanal** (formaldehyde), **propanone** and **propanal** in increasing reactivity with nucleophiles, and explain their differing reactivities. (12pts)

15) Fill in the blanks for **five** of the following reactions. (25pts)

(c)
$$? \xrightarrow{NaOCH_3} ? \xrightarrow{CH_2-OCH_3}$$

$$\begin{array}{c|cccc} CH_2CO_2H & CH_2CONH_2 \\ \hline & ? & \hline & P_2O_5 \\ \hline \end{array} ?$$

(e)
$$\begin{array}{c|c} CH_2CN & CH_2 \stackrel{\circ}{C} Ph & CH_2CH_2Ph \\ \hline & ? & \hline & ? & \hline \end{array}$$

(f)
$$?$$
 $\xrightarrow{SOCl_2}$ $?$ $?$ H

16) Give the mechanism for **one** of the below conversions (10pts)

or

17) Give the starting material and mechanism for $\underline{\mathbf{one}}$ of the following schemes. (19pts)

(b)
$$\frac{\text{Na, NH}_3}{\text{C}_2\text{H}_5\text{OH}}$$

(c)
$$\begin{array}{c}
1) CH_3Br, Ph_3P \\
\hline
2) BuLi \\
3) Warm
\end{array}$$
Ph
Ph
C=CH₂

Bonus question (1pt for within \$5k, 2 pts within \$1k)

What is the base rate 10 month salary (i.e. excluding summer compensation and consultancy, etc) for an assistant chemistry professor at Rutgers?

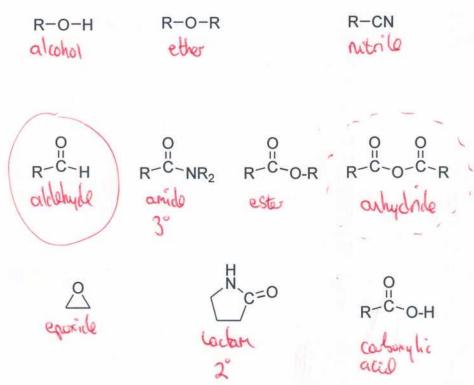
Final Exam for Organic II

200pts(Weighted as 400)

Name PHIL MIBEERGLAZ

Good luck all round!

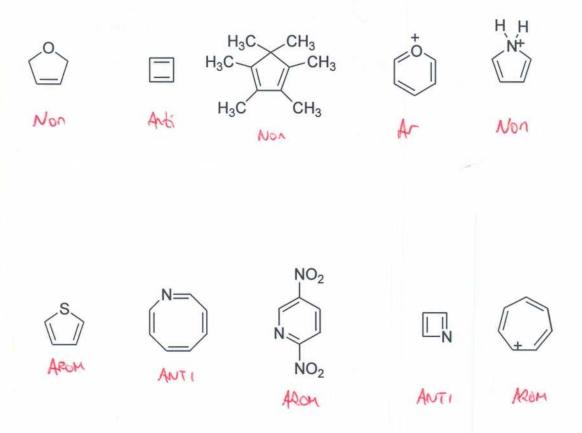
1) Identify the class of compounds each of the following molecules belong to (15pts).



- 2) For each of the <u>amides</u> and <u>amines</u> state whether they are primary, secondary or tertiary (4pts).
- 3) Circle one of the above compounds that is reactive enough to react with neutral water (2pts).
- 4) Give two characteristic physical or chemical properties of <u>aromatic</u> compounds (4pts).

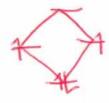


5) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (15pts)



6) Pick one of the above <u>antiaromatic</u> molecules, and use the polygon rule to demonstrate its <u>antiaromaticity</u>. (8pts)

1 8 II



ATT, arti avanatic di-radical state 1

Final Exam for Organic II

7) Give the products in <u>six</u> of the following reactions, paying attention to regio/stereochemistry where applicable. (18pts)

Page 3

8) The below heterocycle contains two Nitrogen atoms, and is 6π Hückel aromatic.

The lone pairs on the two Nitrogens play different roles in the aromaticity of the molecule, and consequently one Nitrogen will get protonated before the other.

Describe which one gets protonated first, and explain their differing basicity.

This N uses it by for aromaticity.

The donation of these 2 electrons to the TT system makes it 6TT Hückel aromatic (10pts) N does not use its le for Protonation of the upper N result in a loss of aromaticity NON- AROMATIC : lower N is more basic

9) Give reagents and conditions to accomplish <u>five</u> of the following transformations. (15pts)

10) The addition of (1 equivalent of) HBr to *cis*-1,2-dimethyl-3,5-cyclohexadiene generates a mixture of products.

Draw the products, predict their approximate ratio, and mechanistically account for the mixture of products. (10pts)

11) Circle the stronger base in the following pairs, and in a sentence explain your choice. (6pts)

(a)
$$O_2N$$
—NH₂

e withdrawing group destablizes the protonated form

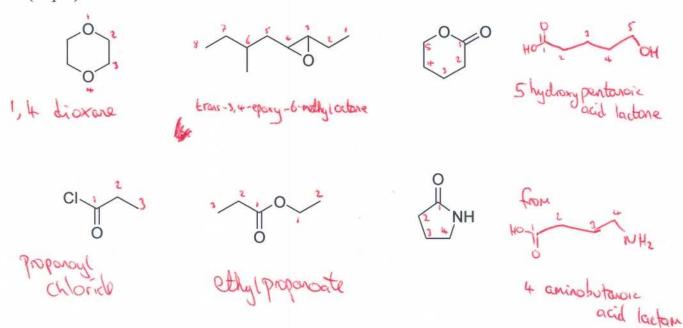
(b)
$$F_3C-N$$
CCH3 H_3C-N CCF3 and close to

12) Circle the stronger acid in the following pairs, and in a sentence explain your answer. (12pts)

(a)
$$H_3C-C-OH$$
 CF_3CH_2-OH

(c)
$$CI_3C-\overset{\circ}{C}-OH$$
 $Br_3C-\overset{\circ}{C}-OH$ Br : Stabilizes arise more

13) Name <u>five</u> of the following compounds in IUPAC acceptable terms. (15pts)



Rank **methanal** (formaldehyde), **propanone** and **propanal** in increasing reactivity with nucleophiles, and explain their differing reactivities. (12pts)

increasing reactivity > (i) stories the betone has two ally substituents blocking the approach of the nucleophile to the electrophilic carbony carbon, where the addelyse has one ally substituent, and the nethand is the most acceptable since it is blocked only by two hydroge afters.

② Electronics: The carbonyl group is polarised thus file, and so increasing alloy substitution will help stabilize the 8+ on the C, but :.

alloy substitution will help stabilize the 8+ on the C, but :.

decrease reactivity due to electrotectic attraction to the incoming nucleophile.

Final Exam for Organic II

Page 8

15) Fill in the blanks for five of the following reactions. (25pts)

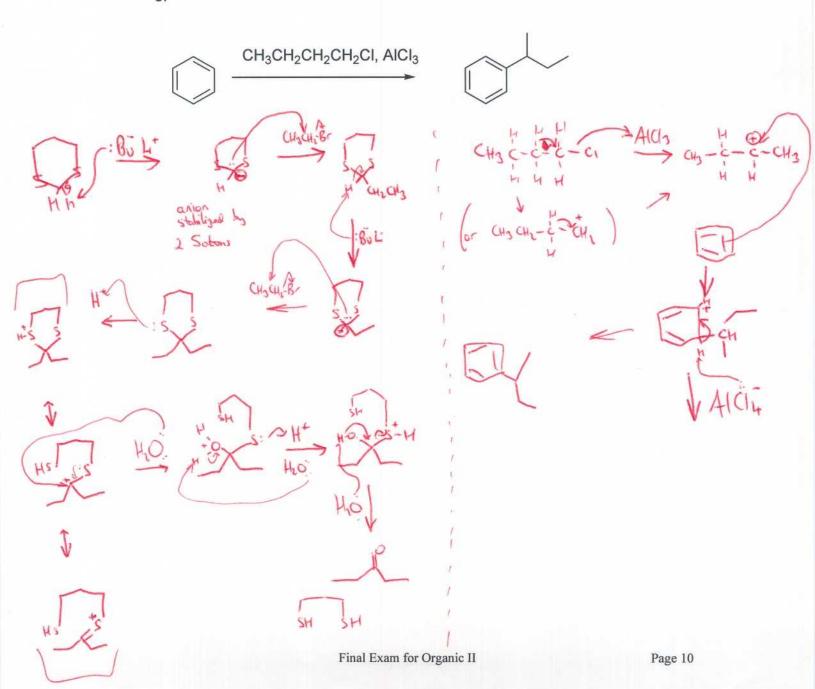
(b)
$$\frac{?}{? \text{ (b)}} \text{ (b)} \qquad \frac{\text{NH}_2}{?} \text{ (b)} \qquad \frac{1) \text{ NaNO}_2, \text{ HCI}}{? \text{ (c)}} ?$$

(d)
$$P_2O_5$$
 ? P_2O_5 ?

(e)
$$CH_2CN$$
 CH_2CH_2Ph CH_2CH_2Ph CH_2CH_2Ph

16) Give the mechanism for **one** of the below conversions (10pts)

or



17) Give the starting material and mechanism for one of the following schemes. (19pts)

(a)
$$\frac{\text{Cl}_2, \text{KOH}}{\text{H}_2\text{O}}$$
 $\frac{\text{NH}_2}{\text{NH}_2}$

(b)
$$Na, NH_3$$
 C_2H_5OH

