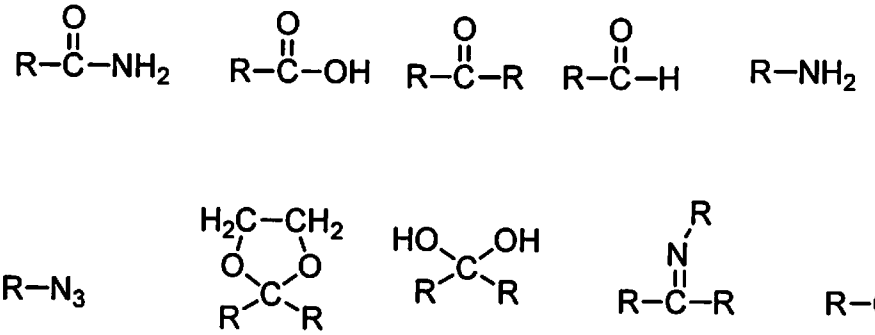
Spring 2006 Org II Exam #2 **Ch 18-19** **(100 points)**

NAME: _____

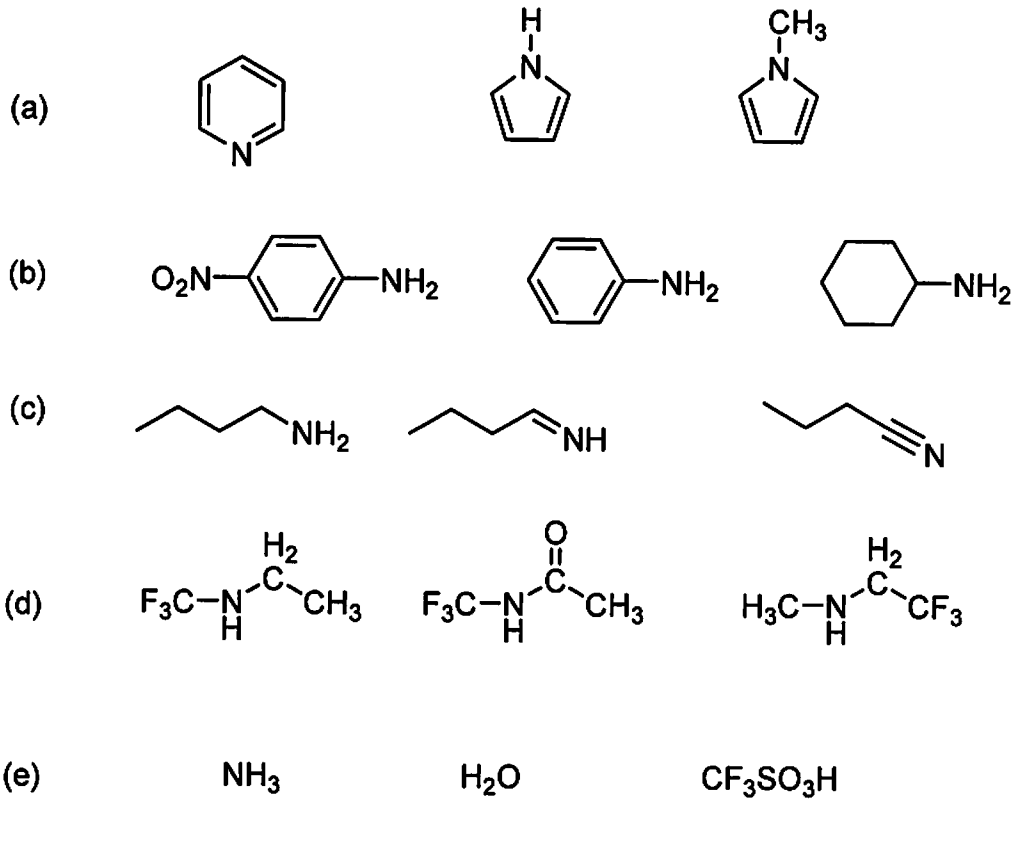
To **not** have your graded script placed outside my office please check this box ☐

1) i) Name the general class of organic compound that each of these molecules belong to.

ii) circle the molecule that has the weakest π bond. (11pts)



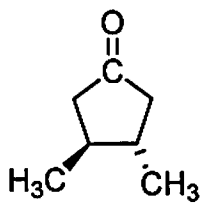
2) Circle the *stronger base* in the following threesomes (no need to explain). (10pts)

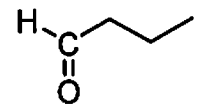


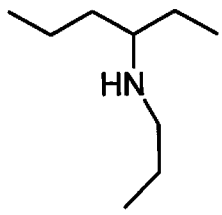
3) Draw the Lewis structure (including lone pairs) for the following molecules. (12pts)

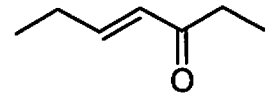
$R-NO_2$ $R-CN$ $R-NCO$ PPh_3

4) Name the following compounds in IUPAC acceptable terms. (15pts)



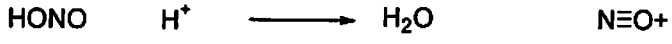






5) Aniline (Ph-NH_2) reacts with nitrous acid (HONO) to form a diazonium salt.
Draw a Lewis structure (with lone pairs) for nitrous acid. (2pts)

During the reaction, Nitrous acid undergoes <u>acid catalyzed dehydration</u> to produce the nitrosonium cation (NO^+). Draw the **mechanism** for this transformation, and show that the nitrosonium cation is **resonance stabilized**. (8pts)



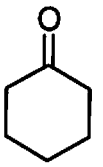
6) What is the definition of a **condensation** reaction? (2pts)

What is the definition of a **protecting group**? (2pts)

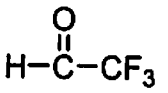
State two facts about **Diazonium Salts**. (2pts)

7) Rank **methanal** (formaldehyde), **propanone** and **propanal** in increasing reactivity with nucleophiles, and explain their differing reactivities. (11pts)

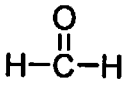
8) Give the products formed in **five** of the following reactions. (15pts)
(if you do all 6 I will just grade the 1st 5).

(a) 

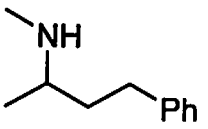
$\xrightarrow[\text{2) BuLi}\\\text{3) warm}]{\text{1)}Ph_3P,\ CH_3\text{-}Br}$

(b) 

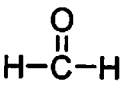
$\xrightarrow{H_2O}$

(c)  $HO{-}NH_2$ $\xrightarrow{H^+}$

(d) $Ph{-}NH_2$ $\xrightarrow[\text{2) CuBr, HBr, heat}]{\text{1) }NaNO_2,\ HCl}$

(e) 

$\xrightarrow[\text{2) }Ag_2O,\ H_2O,\ \text{heat}]{\text{1) excess }CH_3\text{-}Br}$

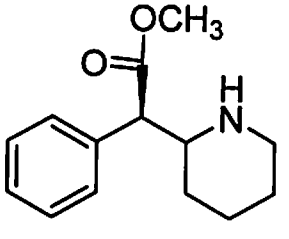
(f) 

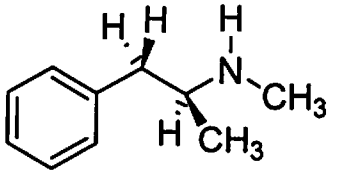
$\xrightarrow[\text{2) }H_3O^+]{\text{1) PhMgBr}}$

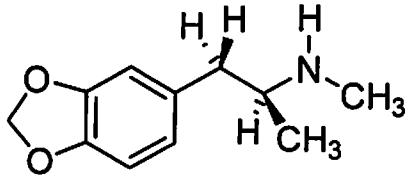
9) Explain why a ketone **must** have three or more carbon atoms. (5pts)

If C=12, H=1 and O=16, draw a ketone that has a molecular weight below 57. (5pts)

***Bonus question* (up to 3pts)**
Provide the common / trivial / street names for these three compounds.







Spring 2006 Org II Exam #2 **Ch 18-19** **(100 points)**

NAME: 10 - YED

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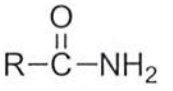
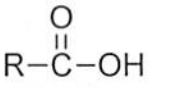
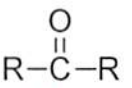
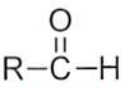
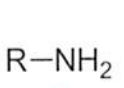
1) i) Name the general class of organic compound that each of these molecules belong to.
ii) circle the molecule that has the weakest π bond. (11pts)


amide

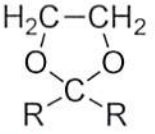

carboxylic acid

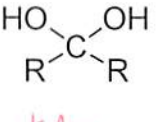

ketone

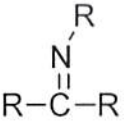

aldehyde

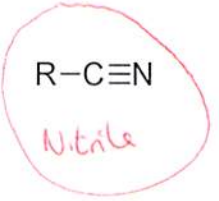

amine


Azido


cyclic acetal

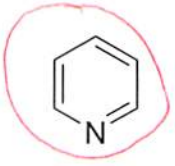

ketone hydrate

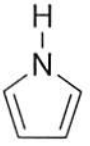

Imine

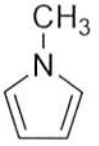

Nitrile

2) Circle the *stronger base* in the following threesomes (no need to explain). (10pts)

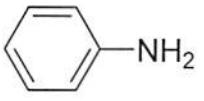
(a)

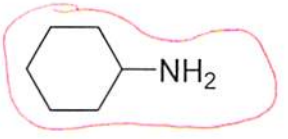




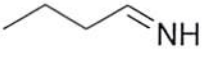


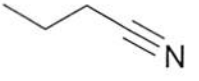
(b)



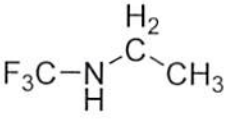


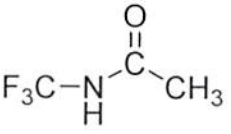
(c)

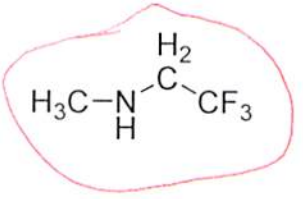




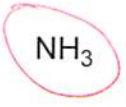
(d)







(e)

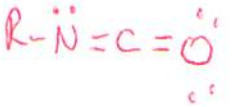


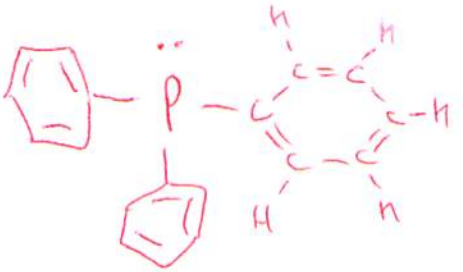
H_2O

CF_3SO_3H

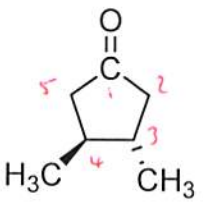
3) Draw the Lewis structure (including lone pairs) for the following molecules. (12pts)

$R-NO_2$ $R-CN$ $R-NCO$ PPh_3

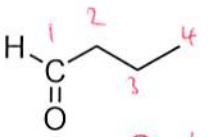




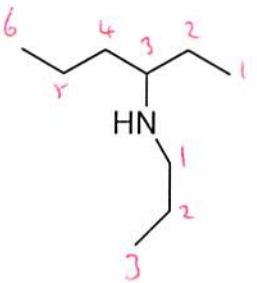
4) Name the following compounds in IUPAC acceptable terms. (15pts)



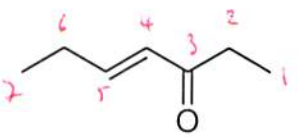
Trans-3,4-dimethylcyclopentanone



Butanal



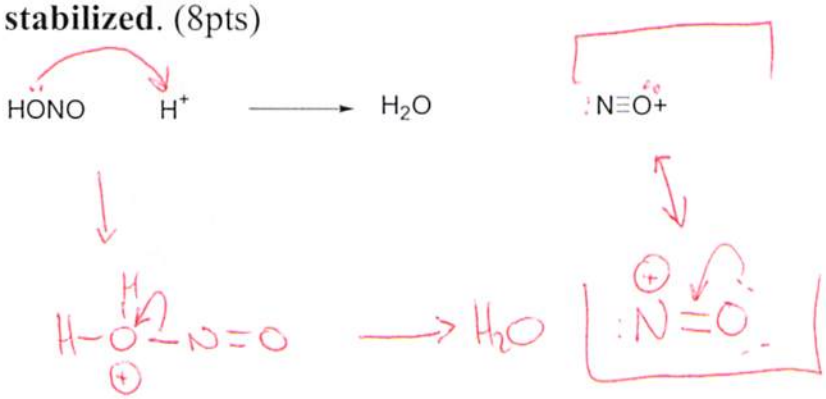
N-propylHexan-3-amine



(E)-Hept-4-en-3-one

5) Aniline (Ph-NH_2) reacts with nitrous acid (HONO) to form a diazonium salt.
Draw a Lewis structure (with lone pairs) for nitrous acid. (2pts)

During the reaction, Nitrous acid undergoes <u>acid catalyzed dehydration</u> to produce the nitrosonium cation (NO^+). Draw the **mechanism** for this transformation, and show that the nitrosonium cation is **resonance stabilized**. (8pts)



6) What is the definition of a **condensation** reaction? (2pts)

A reaction where two species add together, and expel a small molecule (usually H_2O).

What is the definition of a **protecting group**? (2pts)

A protecting group is something you add to a functional group so that it will not react.

Ideally it should be readily removed to regenerate the original functional group.

State two facts about **Diazonium Salts**. (2pts)

Alkyl diazonium salts are very unstable. Aryl diazonium salts are stable 0-5°C.

Formed from R-NH_2 with $NaNO_2$/HCl. Lewis structure: $R-\overset{\oplus}{N}\equiv N$

7) Rank **methanal** (formaldehyde), **propanone** and **propanal** in increasing reactivity with nucleophiles, and explain their differing reactivities. (11pts)

$CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ < $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-H$ < $H-\overset{O}{\overset{\|}{C}}-H$

propanone — propanal — methanal

More Reactive →

(1) Sterics: The propanone carbonyl group is the most sterically hindered, and therefore the nucleophile is discouraged from attacking the carbonyl carbon atom. Methanal has the most easily attacked carbon from the point of view of sterics.

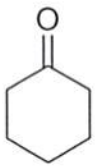
(2) Electronics: A nucleophile is attracted to the +ve charge of the carbonyl carbon.

Alkyl substituents are electron donating, and thus reduce the amount of +ve charge on the carbon.

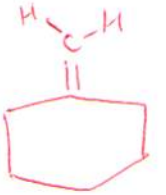
$\delta-$ O
$\delta+$ $\overset{O}{\overset{\|}{C}}$ C_1

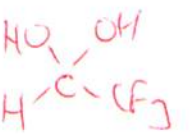
∴ Ketones are less reactive than aldehydes, and $H-\overset{O}{\overset{\|}{C}}-H$ is the most reactive.

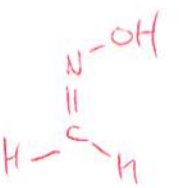
8) Give the products formed in **five** of the following reactions. (15pts)
(if you do all 6 I will just grade the 1st 5).

(a) 

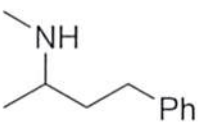
$\xrightarrow[\text{2) BuLi}\\\text{3) warm}]{\text{1)}Ph_3P,\ CH_3\text{-}Br}$



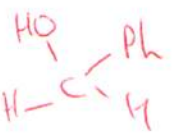
(b) $H-\overset{\overset{O}{\|}}{C}-CF_3$ $\xrightarrow{H_2O}$ 

(c) $H-\overset{\overset{O}{\|}}{C}-H$ $HO-NH_2$ $\xrightarrow{H^+}$ 

(d) $Ph-NH_2$ $\xrightarrow[\text{2) CuBr, HBr, heat}]{\text{1) }NaNO_2,\ HCl}$ Ph-Br

(e) 

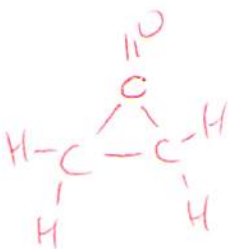
$\xrightarrow[\text{2) }Ag_2O,\ H_2O,\ \text{heat}]{\text{1) excess }CH_3\text{-}Br}$

(f) $H-\overset{\overset{O}{\|}}{C}-H$ $\xrightarrow[\text{2) }H_3O^+]{\text{1) PhMgBr}}$ 

9) Explain why a ketone **must** have three or more carbon atoms. (5pts)

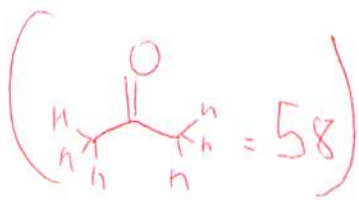
A ketone must contain a $-\overset{\overset{O}{\|}}{C}-$, and also have two alkyl or aryl substituents, therefore there must be at least 3 carbons.

If C=12, H=1 and O=16, draw a ketone that has a molecular weight below 57. (5pts)

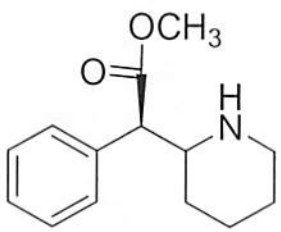


$C_3OH_4 = 56$

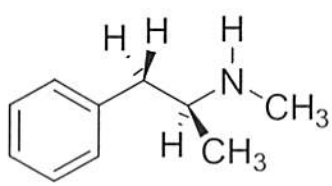
54



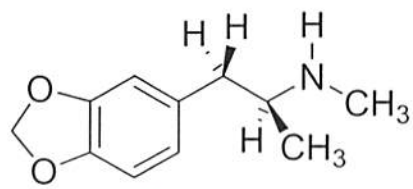
***Bonus question* (up to 3pts)**
Provide the common / trivial / street names for these three compounds.



Ritalin
(Ridilin)



Methamphetamine
(Speed, crank, tweak, crystal meth...



mdma
ecstacy
X
E