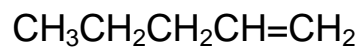
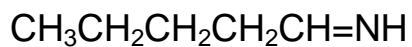
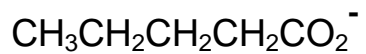
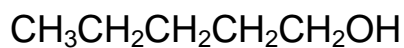
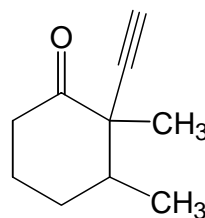
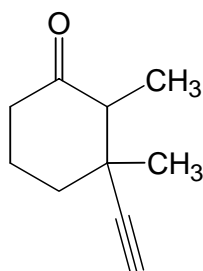
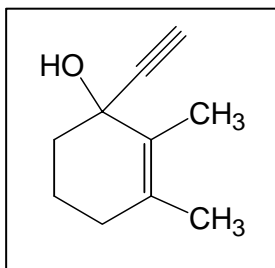
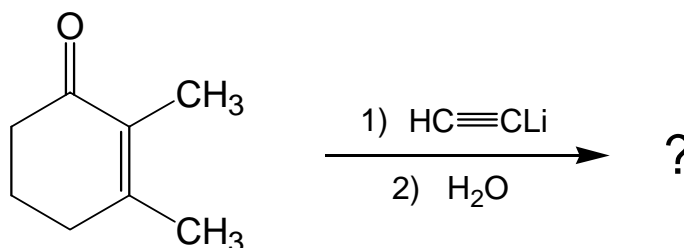


1. Multiple Choice Questions. Clearly circle your chosen answer. (30 points; 3 apiece)

a) What product is formed when $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$ reacts with $\text{Ag}_2\text{O}/\text{NH}_4\text{OH}$?

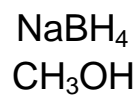
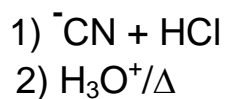


b) What is the major product of the following reaction?



No
Reaction

c) Which reagents can be used to convert an aldehyde into a primary alcohol?



none of
them

Name: **KEY**

d) Which compound has a ^1H NMR signal that is furthest downfield?

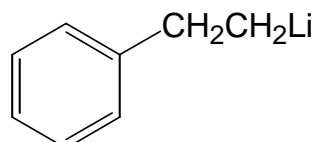
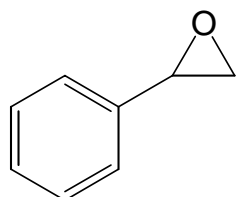
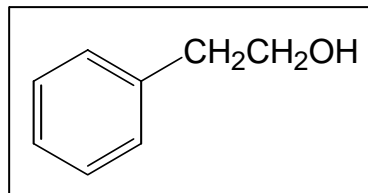
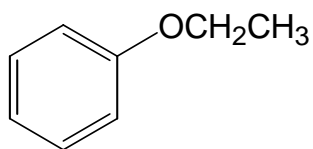
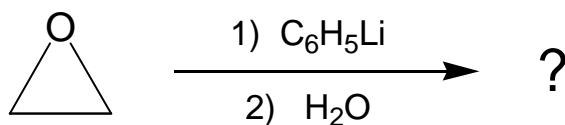
benzaldehyde

benzyl alcohol

benzyl bromide

acetophenone

e) What is the product of the following reaction?



f) Which reagent converts $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$ into $\text{C}_6\text{H}_5\text{CHO}$?

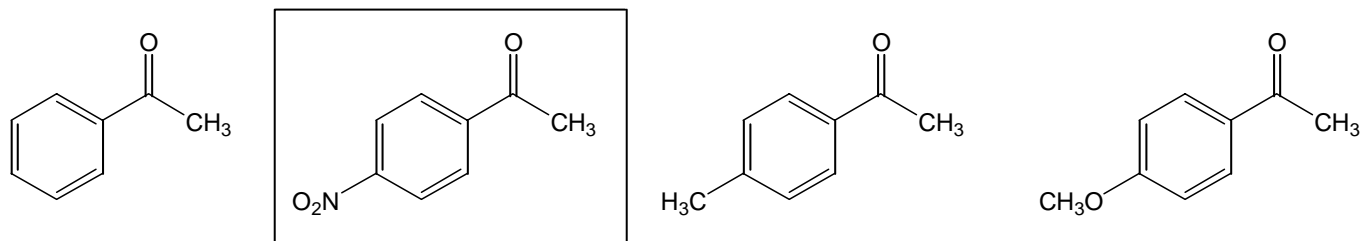
$\text{Ag}_2\text{O} + \text{NH}_4\text{OH}$

CrO_3 in
aqueous
 H_2SO_4

PCC in
 CH_2Cl_2

DIBAL-H

g) Which compound forms the highest percentage of hydrate at equilibrium?



h) In what type of orbital does the lone pair on N of CH_3CN reside?

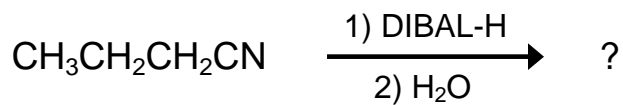
sp^2

2p

sp

sp^3

i) What is the product of the following reaction?



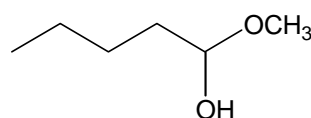
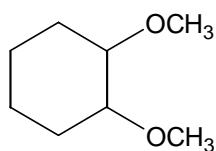
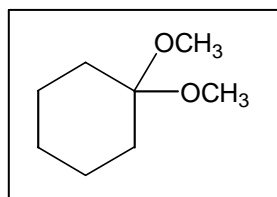
$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{NH}$

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$

j) Which compound is an acetal?

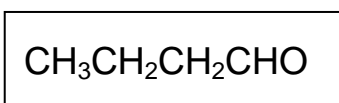


none of them

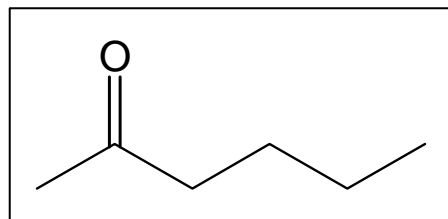
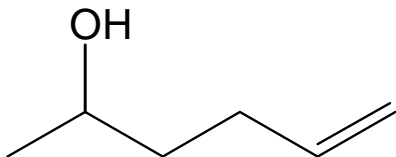
Name: **KEY**

2. Comparison Questions. Clearly circle your chosen answer. (14 points; 2 apiece)

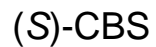
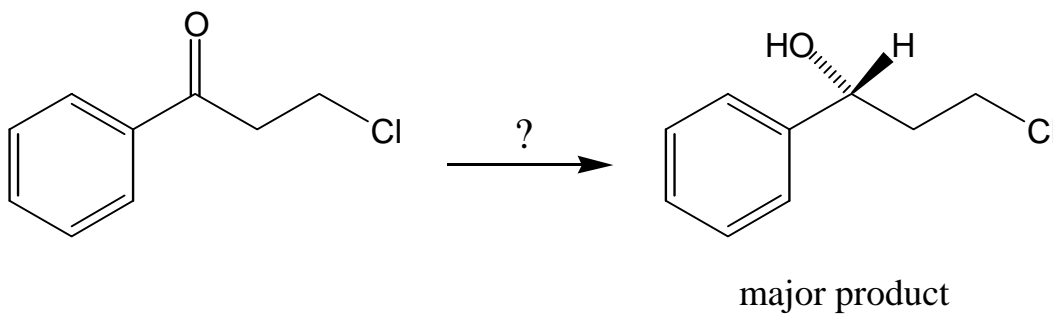
a) Which compound is more reactive toward nucleophilic attack?



b) What product is formed when CH3COCH2CH2CH=CH2 is treated with 1 equivalent of H_2 in the presence of Pd/C?



c) Which reagent is used to effect the following transformation?

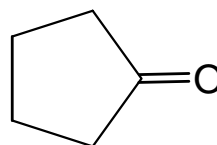
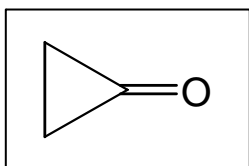


d) Which reagent is used to convert $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{COCl}$ to $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CHO}$?

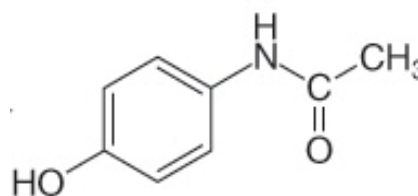
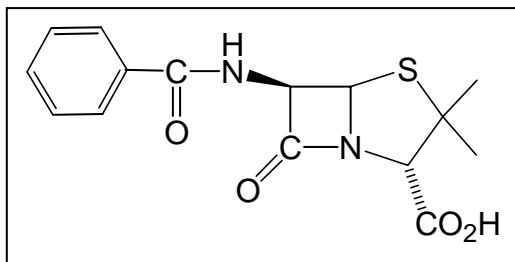
DIBAL-H

$\text{LiAlH}(\text{O}-t\text{-Bu})_3$

e) Which compound has the higher $\text{C}=\text{O}$ stretching frequency in the IR?



f) Which molecule is a penicillin antibiotic?



g) Which compound forms the higher percentage of *gem*-diol at equilibrium?

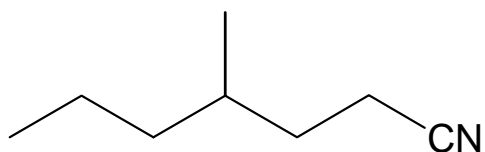
$\text{CH}_3\text{CH}_2\text{CHO}$

$\text{CH}_3\text{CF}_2\text{CHO}$

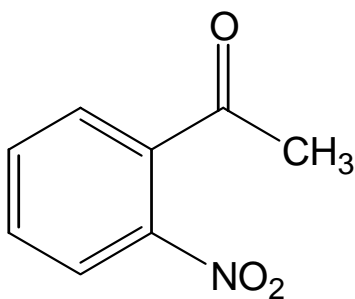
Name: **KEY**

3. Draw structures or provide names for the following compounds. Names are right or wrong.
No partial credit. (12 points; 4 apiece)

a) 4-methylheptanenitrile



b)



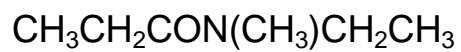
***o*-acetylnitrobenzene**

***o*-nitroacetophenone**

2-nitroacetophenone

1-acetyl-2-nitrobenzene

c)



***N*-ethyl-*N*-methylpropanamide**

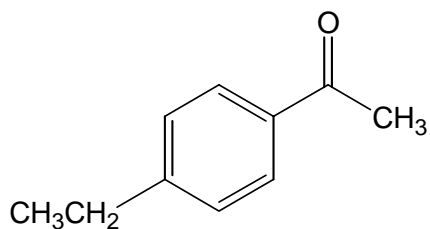
***N*-ethyl-*N*-methylpropionamide**

4. Structures from Spectroscopic Data (8 points; 4 apiece)

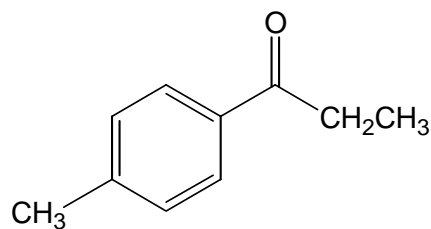
a) Propose a structure for a compound $C_{10}H_{12}O$ that give the following spectroscopic data.

IR absorption at 1686 cm^{-1}

$^1\text{H NMR}$: $\delta 1.21\text{ ppm}$ (triplet, 3H); $\delta 2.39\text{ ppm}$ (singlet, 3H); $\delta 2.95\text{ ppm}$ (quartet, 2H); $\delta 7.24\text{ ppm}$ (doublet, 2H); $\delta 7.85\text{ ppm}$ (doublet, 2H);



Or



b) A compound with the formula $C_{11}H_{14}O_2$ has an absorption at 1720 cm^{-1} in the IR and the following $^1\text{H NMR}$ data:

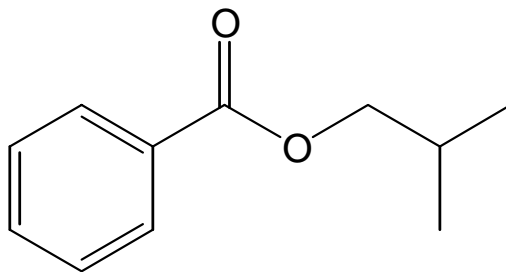
$\delta 1.0$ doublet (6H)

$\delta 2.1$ multiplet (1H)

$\delta 4.1$ doublet (2H)

$\delta 7.8$ multiplet (5H)

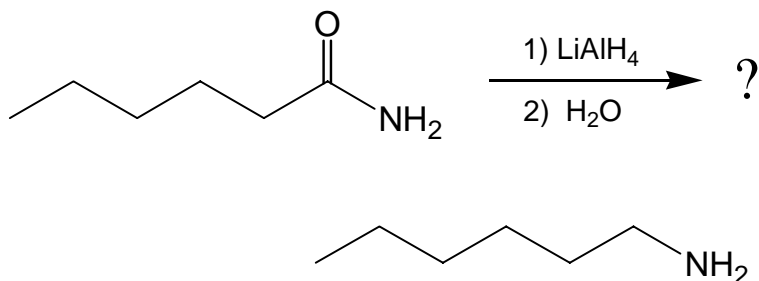
What is the structure of this compound?



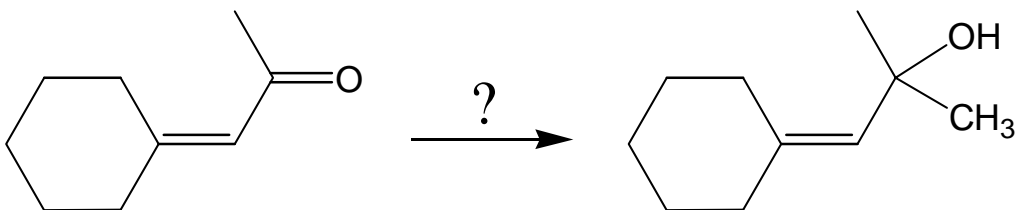
Name: **KEY**

5. Provide the missing products or reactants for the following reactions, clearly indicating stereochemistry where appropriate. If more than one product is formed, indicate which is the major and which the minor product. If there is no reaction, so indicate. If multiple steps are required, clearly show reagents for each step. (28 points; 4 apiece)

a)



b)

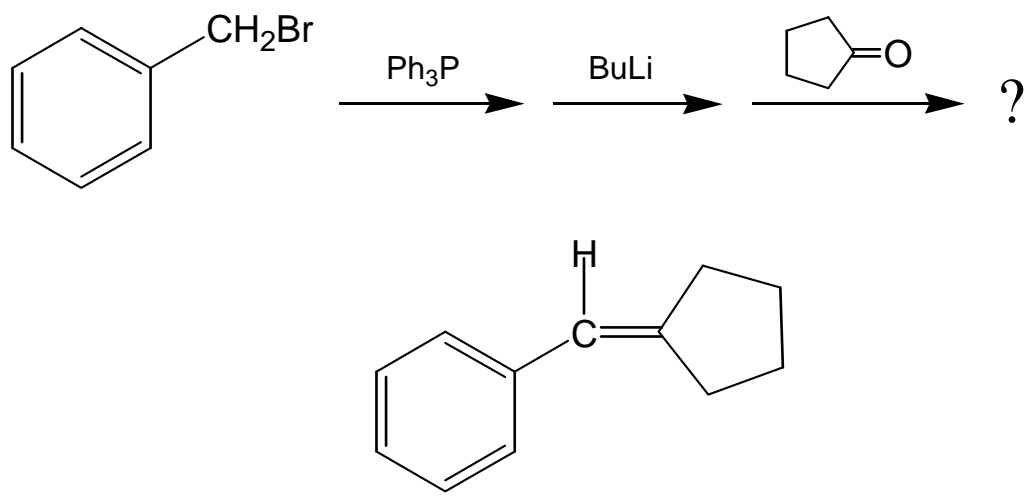


1) CH_3MgBr
2) H_2O

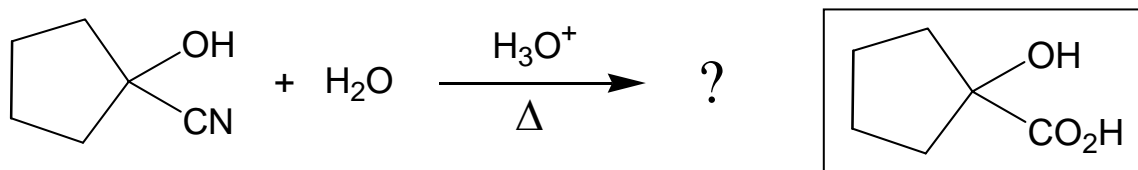
Or

1) CH_3Li
2) H_2O

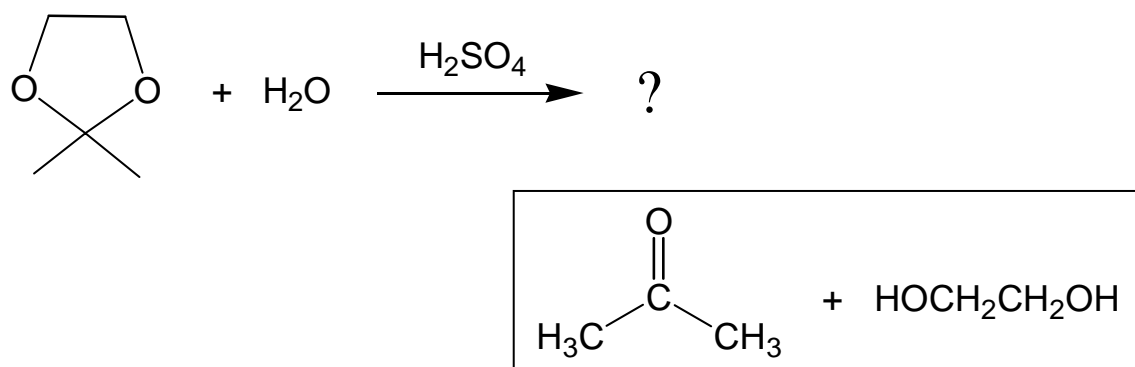
c)



d)

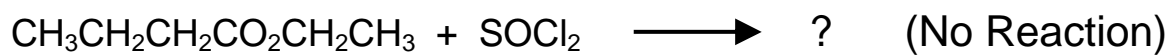


e)

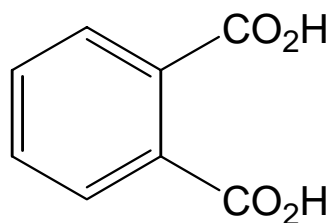
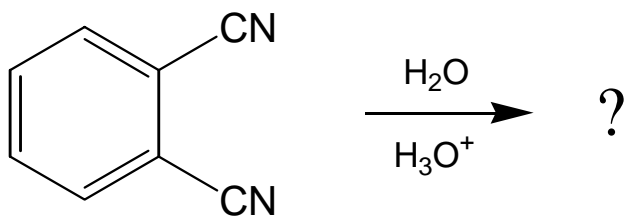


Name: KEY

f)



g)



6. Draw a stepwise, electron-pushing mechanism for the following reaction. (8 points)

