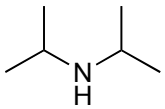
1-10. Multiple Choice. Choose the best answer for the following questions. (30 pts)

1) The p$K_a$ of ethyl cyanoacetate is 9. Which of the following bases will give the most ethyl cyanoacetate enolate. The p$K_a$'s of the conjugate acids are given.

a)  p$K_a$= 11

b) $HO^-$ p$K_a$= 15.7

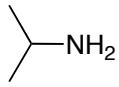
c) $(H_3C)_3CO^-$ p$K_a$= 18

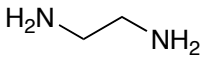
d) Basicity and p$K_a$ are not related

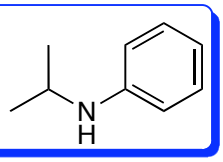
2. The Claisen condensation is most closely related to . . . .

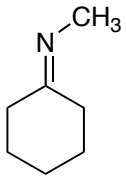
a) electrophilic substitution
b) 1,2-addition (direct addition)
c) 1,4-addition (conjugate addition)
d) nucleophilic acyl substitution

3. Which of the following is a secondary amine?

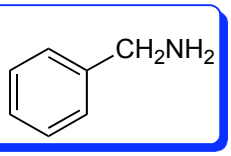
a) 

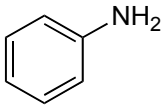
b) 

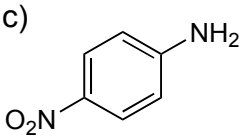
c) 

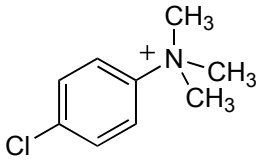
d) 

4. Which of the following is predicted to be the strongest base?

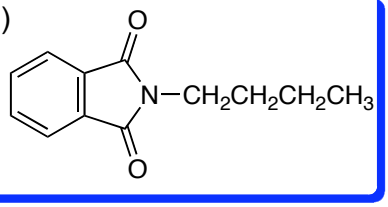
a) 

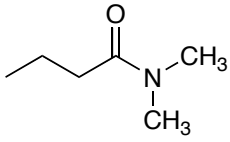
b) 

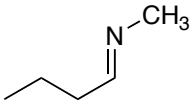
c) 

d) 

5. Which of the following can be directly converted to 1-aminobutane?

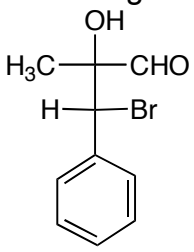
a) 

b) 

c) 

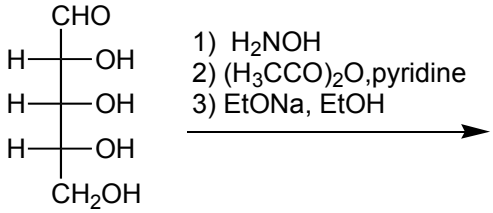
d) all of the above; **a**, **b**, and **c** can be directly converted to 1-aminobutane

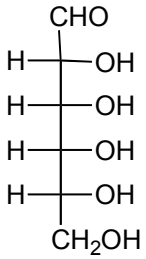
6. Determine the stereochemistry of the following Fischer projection.

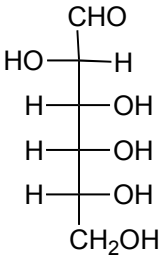


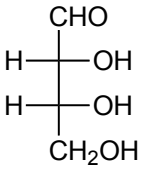
a) (2*S*, 3*S*) b) (2*S*, 3*R*) c) (2*R*, 3*R*) s) (2*R*, 3*S*)

7. Determine the product(s) of the following reaction:



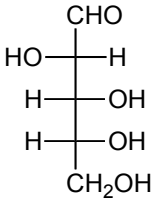

a) 

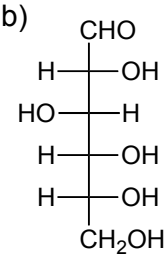

b) 

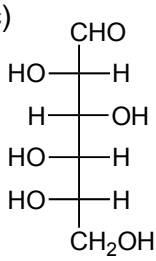

c) 

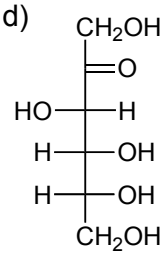

d) **a** and **b** will be produced, but not **c**

8. Which of the following is classified as a D-aldohexose?

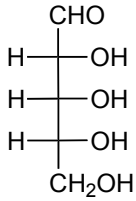
a) 


b) 


c) 

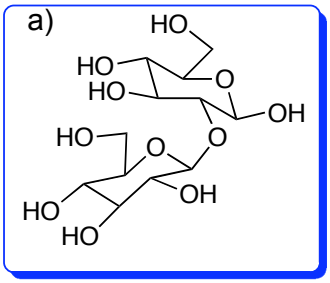

d) 

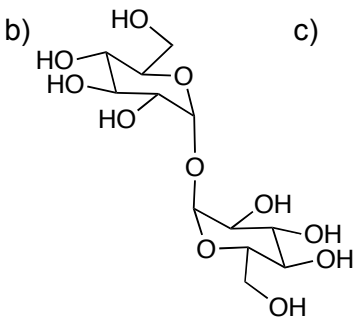

9. Which reagent will react with ribose (shown below) to give an optically active product?

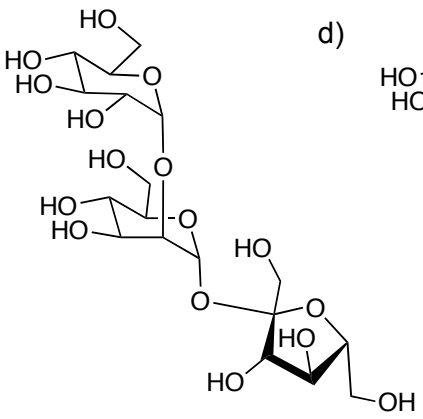


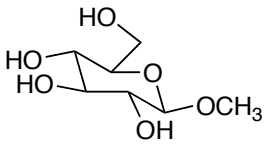

a) $HNO_3$, heat
b) $NaBH_4$
c) $H_3COH$, $H^+$
d) none of the above; ribose reacts with **a**, **b**, and **c** to give optically inactive products

10. Which of the following is a reducing sugar?

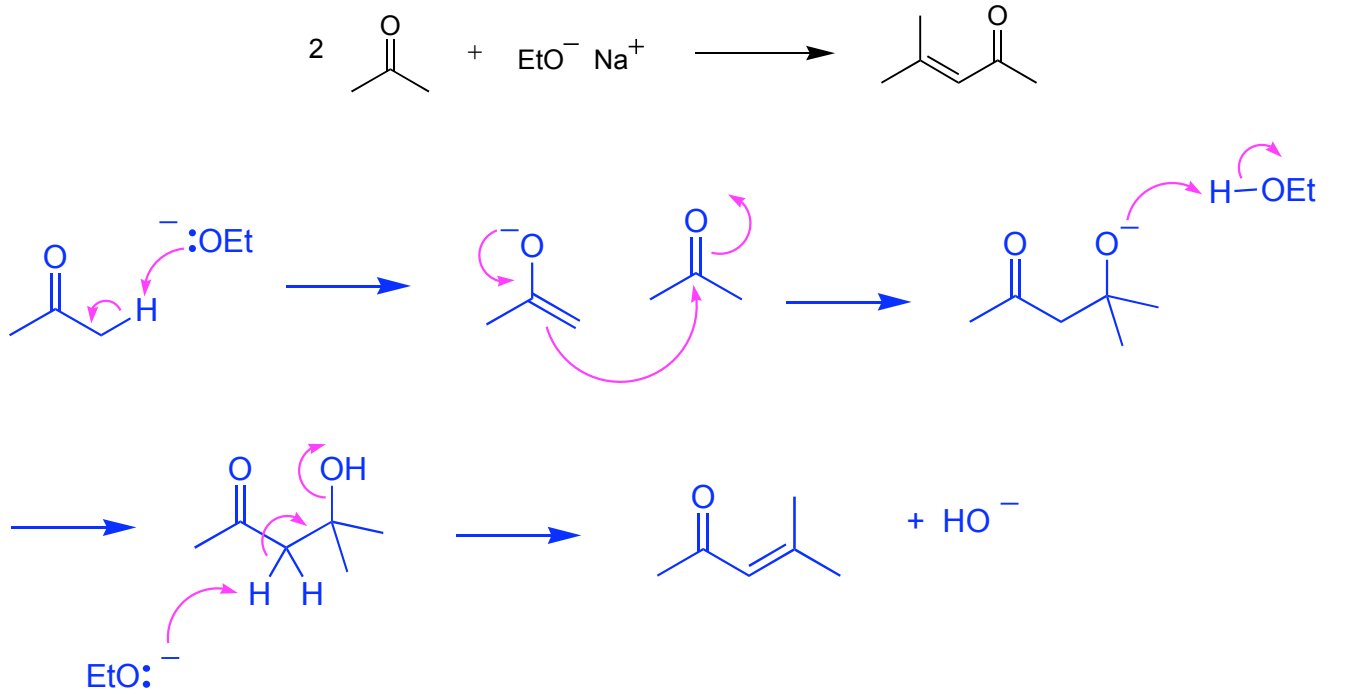
a) 


b) 

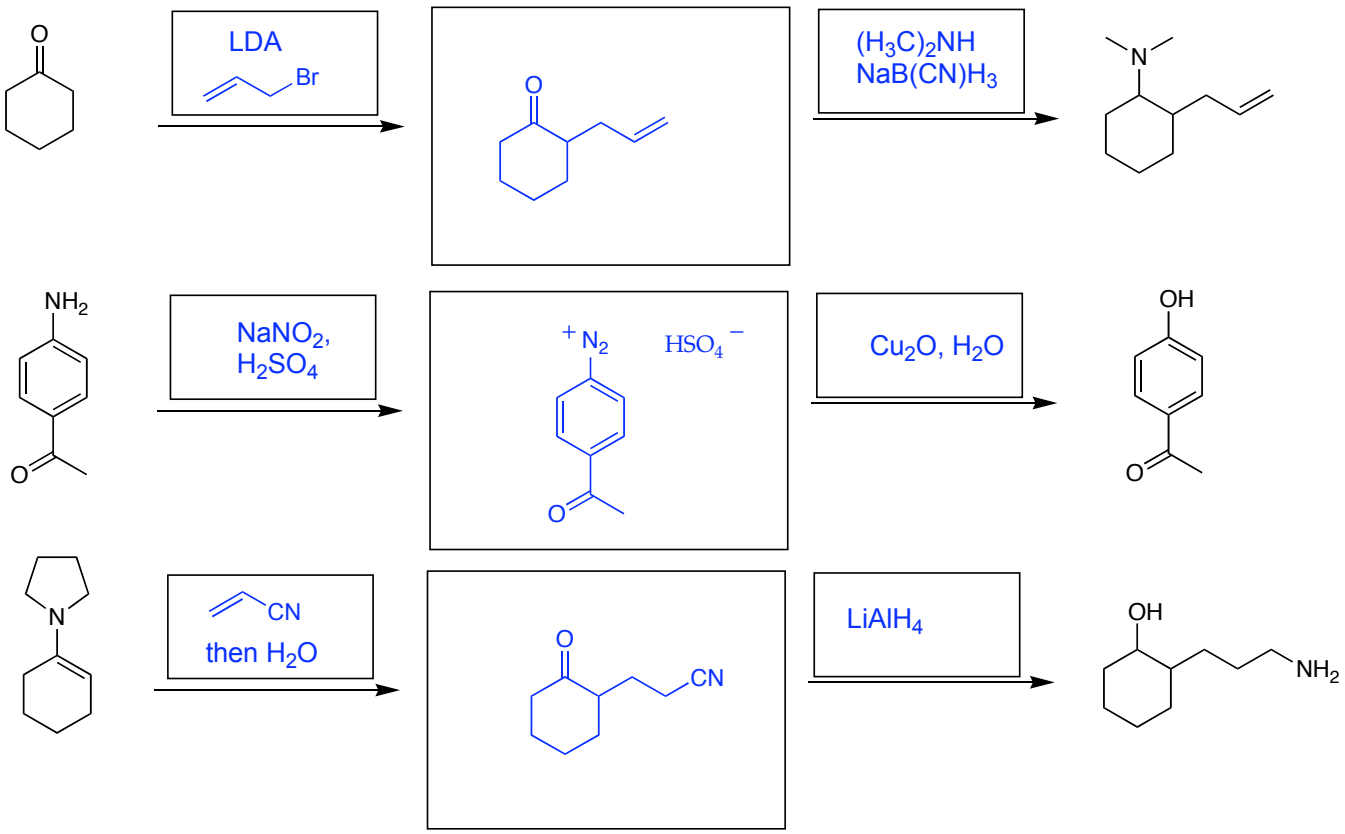

c) 


d) 

11. Give a complete mechanism for the following reaction. (12 pts)

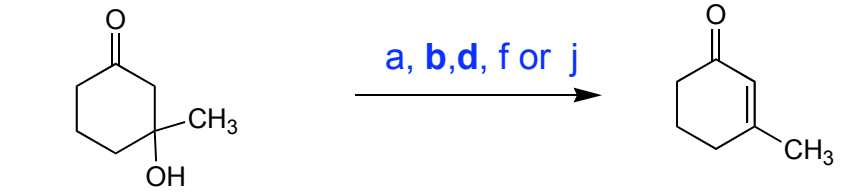


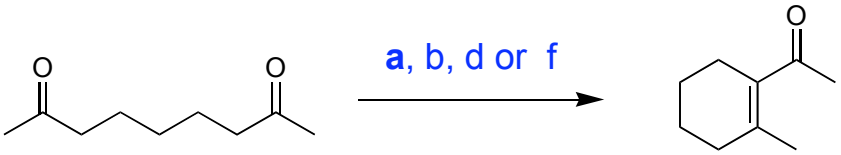

12. Provide the necessary reagents and give the intermediates for the following sequences: (28 pts)

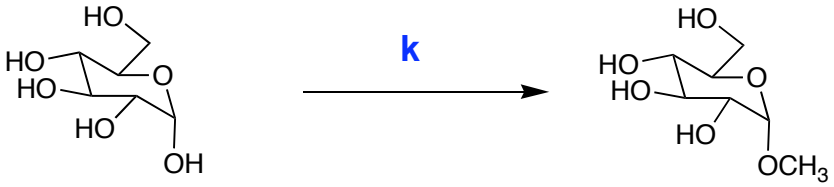


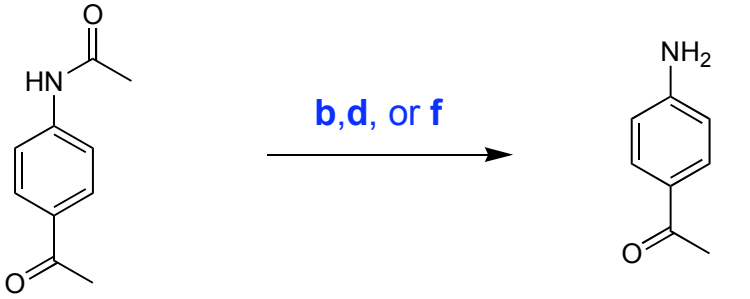
13. Choose the best reagent for the following reactions. (18 pts)

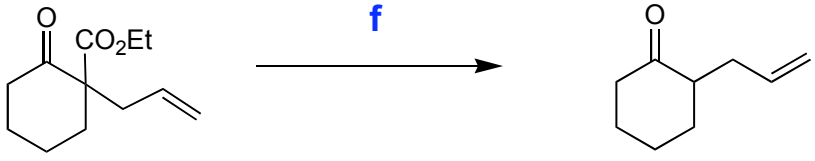
**a**. NaOEt, ethanol
**b**. $H_3O^+$
**c**. $H_3C$-I, NaH
**d**. NaOH, $H_2O$
**e**. $SOCl_2$
**f**. $H_3O^+$, then heat
**g**. $LiAlH_4$, then $H_3O^+$
**h**. $Br_2$, $PBr_3$, then $H_2O$
**i**. $Br_2$, $H_3CCO_2H$
**j**. $POCl_3$, pyridine
**k**. $H_3COH$, $H^+$
**l**. HBr

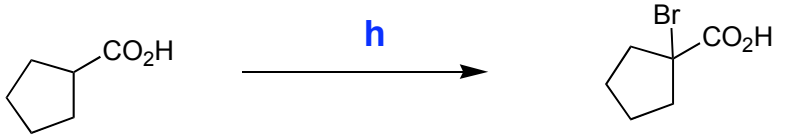


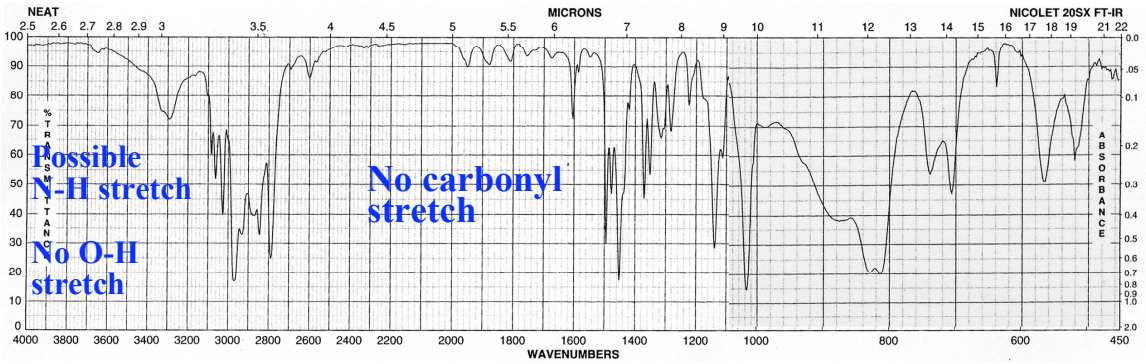



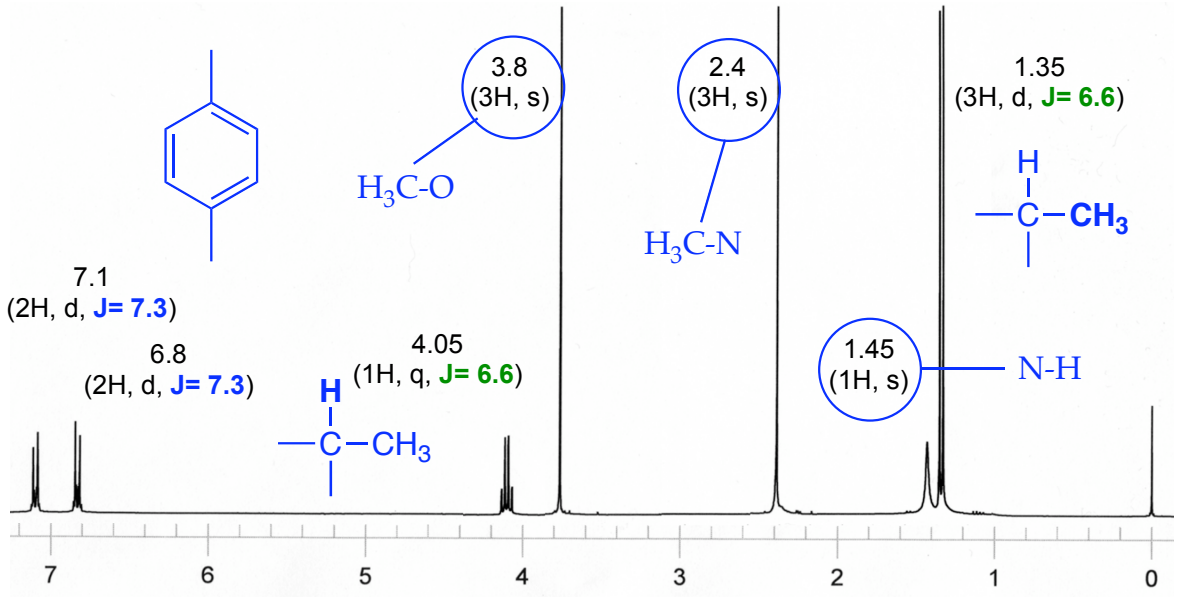



14. Provide a structure that is consistent with the following data. Show your reasoning. (12 pts)

Formula: **$C_{10}H_{15}NO$** **4 units of unsaturation**




**$^{13}$C NMR:** 159.0, 131.0, 129.0, 114.0, 60.5, 56.0, 33.3, 21.8