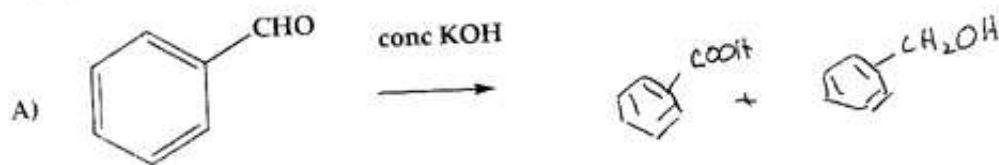
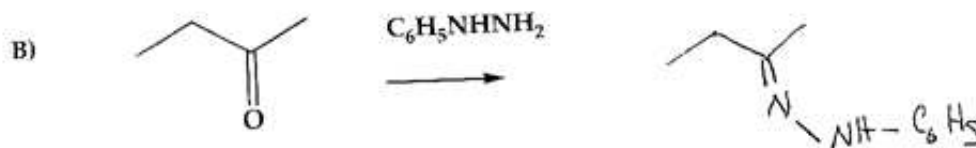


Name: Key (please print)

1. (20 pts) Predict the product expected from each of the following:



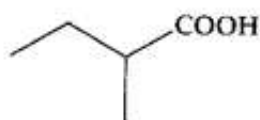
5



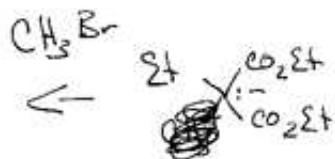
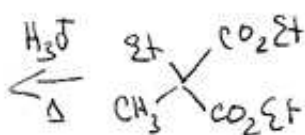
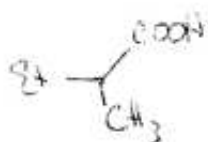
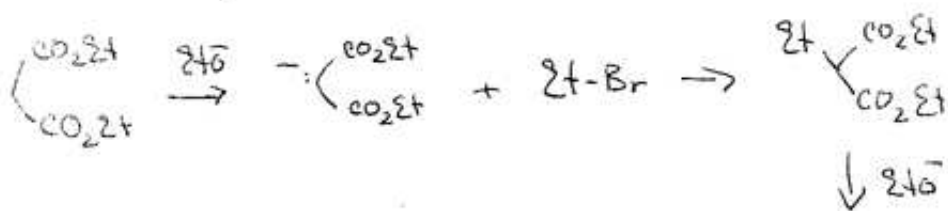
5

2. (20 pts) Starting with any reagents, use a malonic ester synthesis or the acetoacetic ester synthesis to synthesize the following:

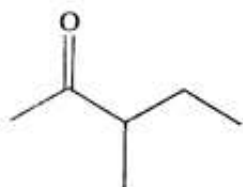
A)



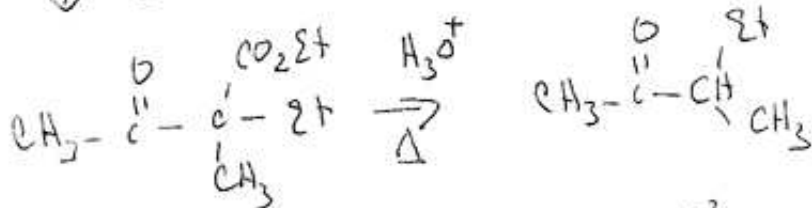
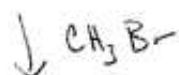
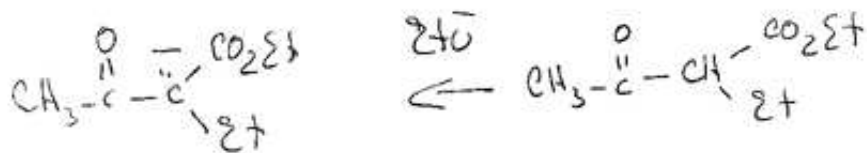
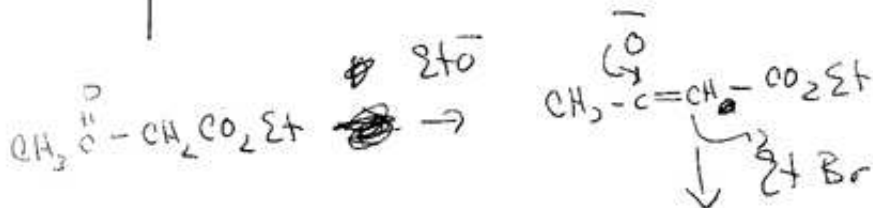
(5)



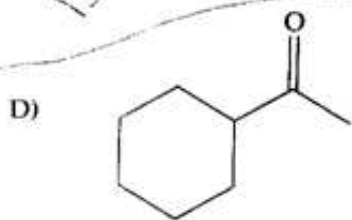
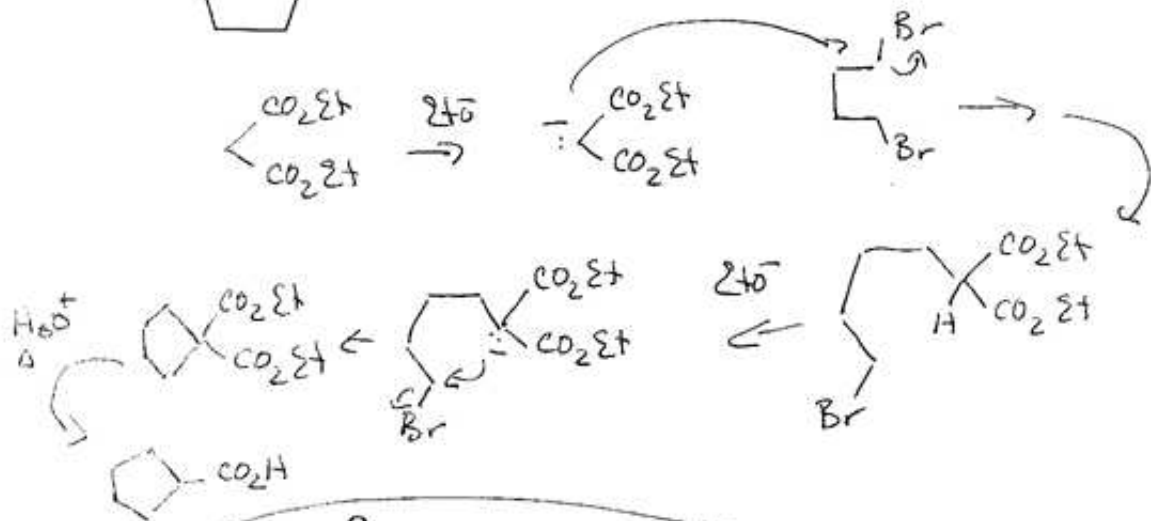
B)



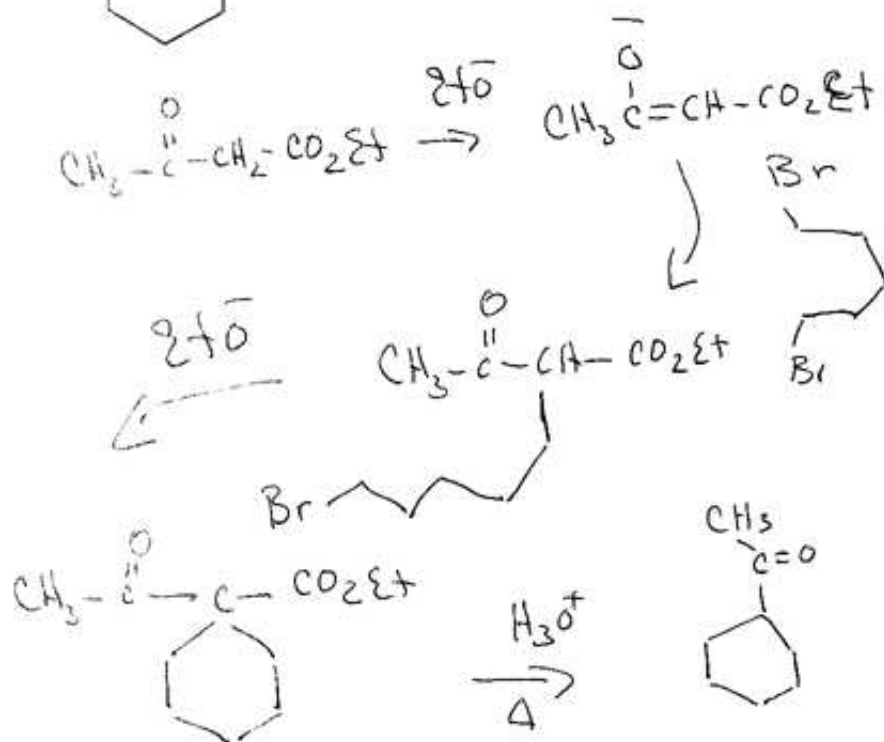
(5)



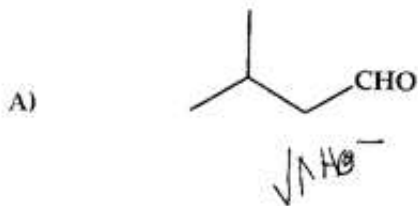
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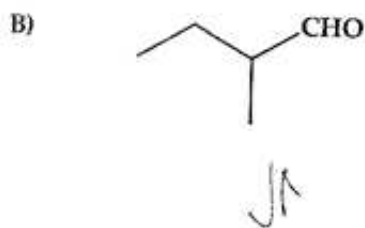
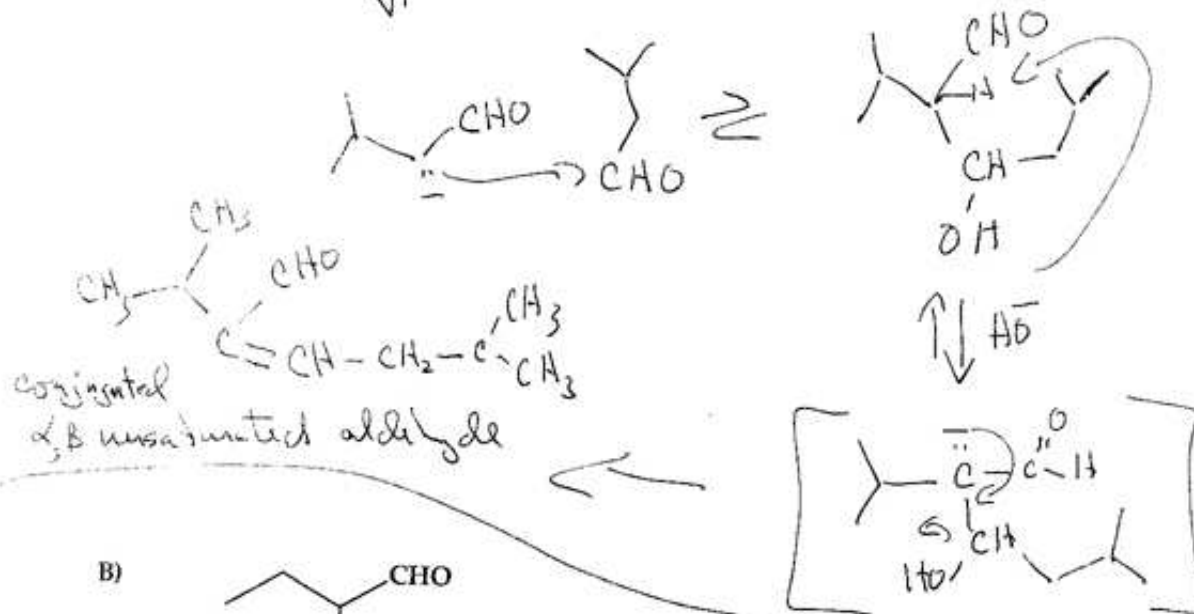
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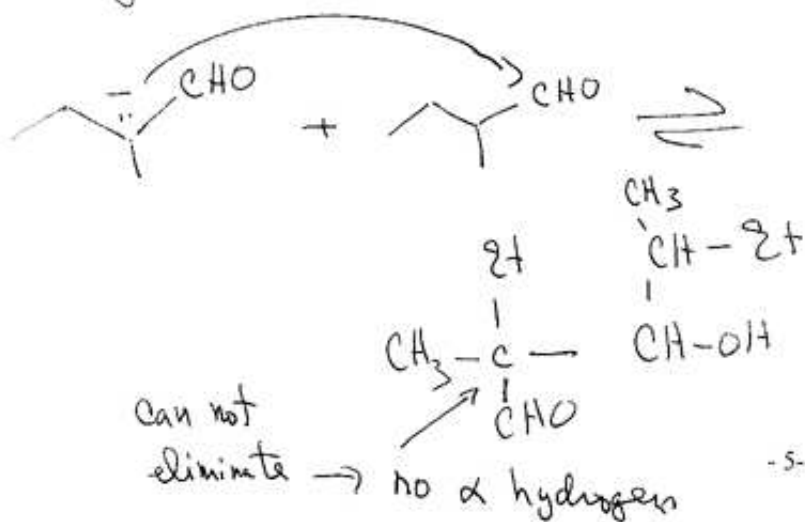
3. (10 pts) The base catalyzed aldol reaction of compound A results in an α, β -unsaturated aldehyde. However the analogous reaction of the isomer, B, results in a β -hydroxyl alcohol. Explain.



(5)

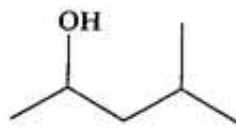


(5)

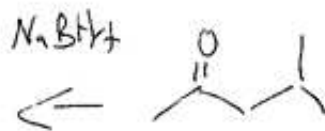
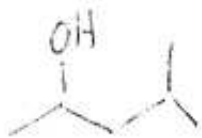
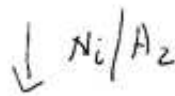
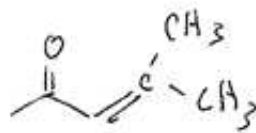
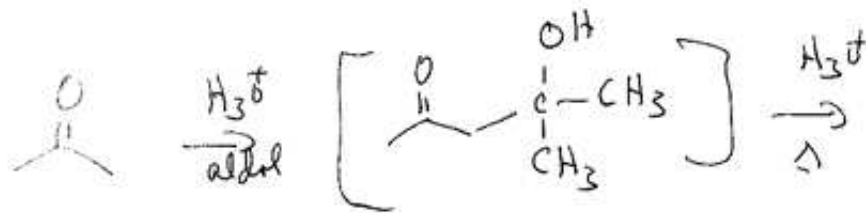


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4. (10 pts) Design a synthesis of the following compound, deriving all of the carbons from reagents having no more than three carbons.

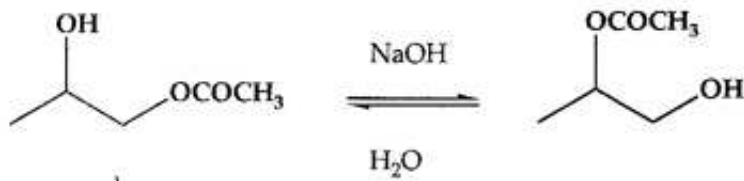


Lots of ways:



10

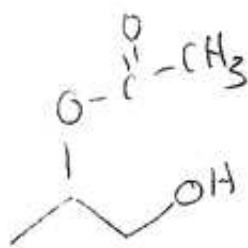
5. (10 pts) In the presence of dilute base, the monoesters of 1, 2-diols rapidly equilibrate:



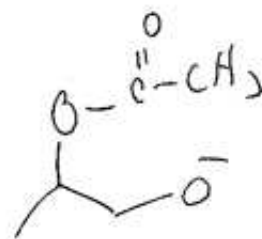
↕



↕



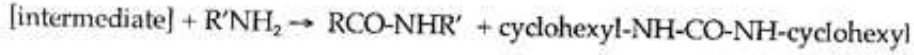
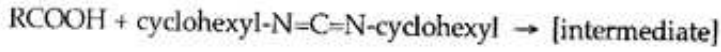
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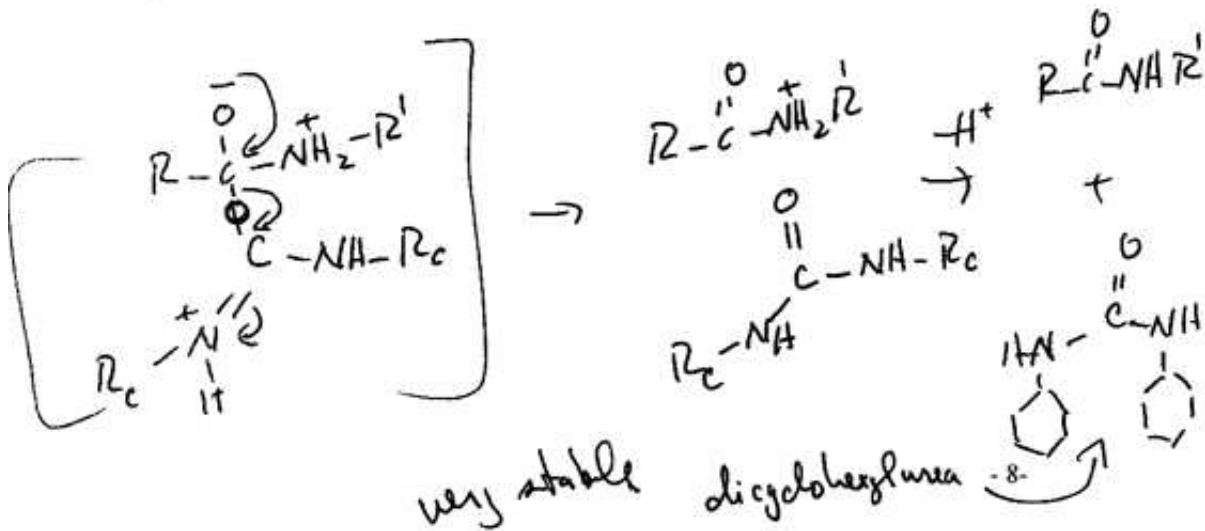
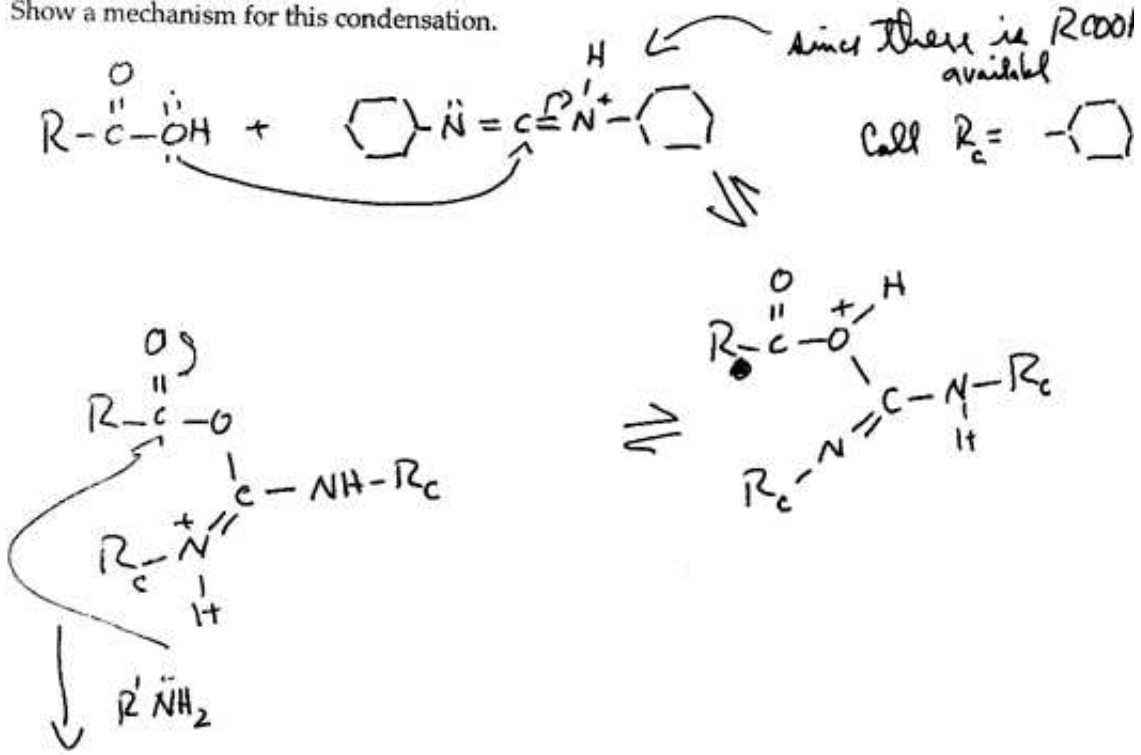
↕ H₂O



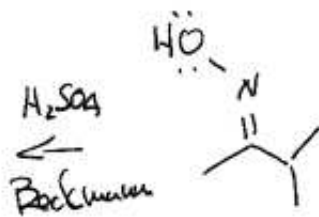
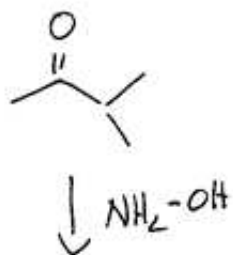
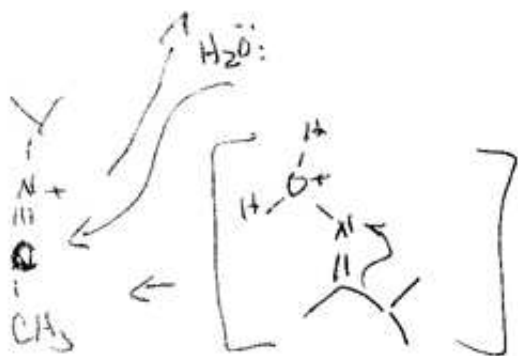
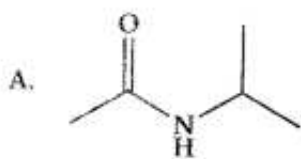
6. (10 pts) Dicyclohexylcarbodiimide, $C_6H_{11}-N=C=N-C_6H_{11}$, is a wonderful condensation reagent that facilitates the formation of a peptide bond.



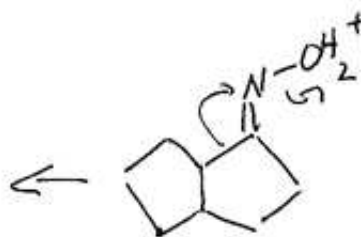
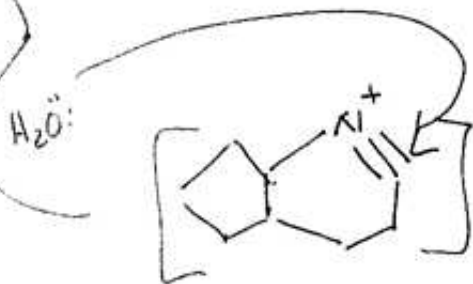
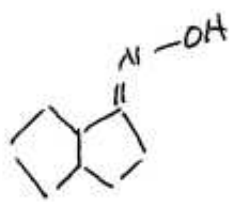
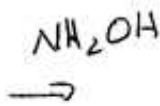
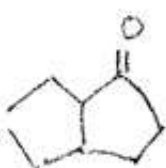
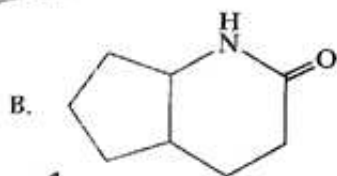
Show a mechanism for this condensation.



7. (10 pts) Suggest a synthesis of the following amides. A convenient route would be to use NH_2OH and any ketone you like (think of a Beckmann rearrangement).



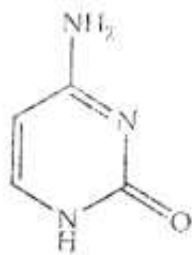
(5)



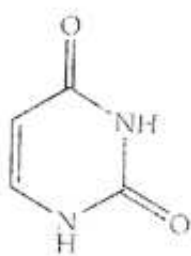
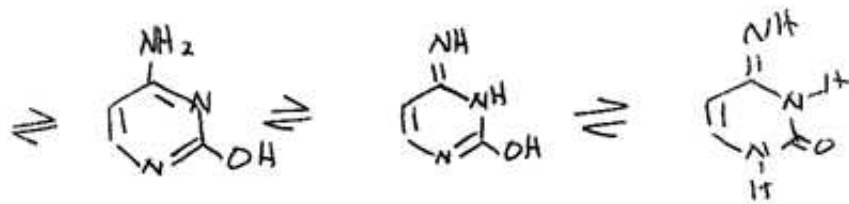
(5)

(5)

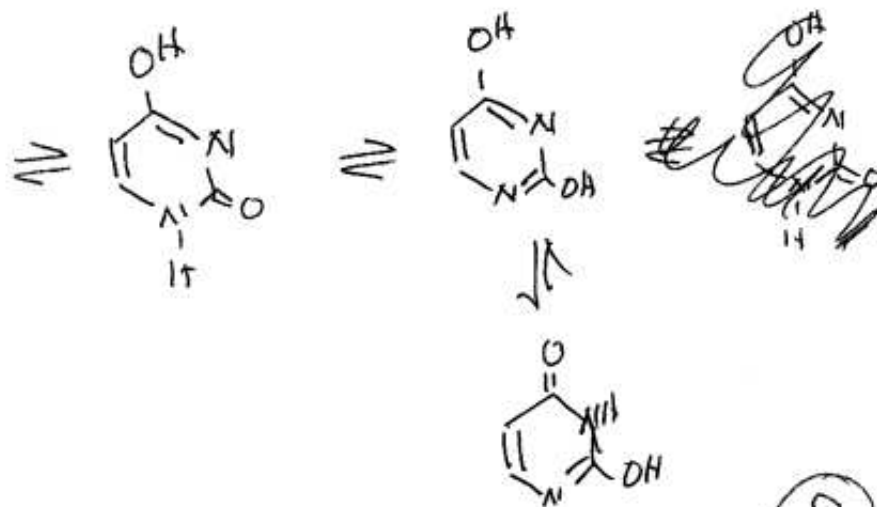
8. (10 pts) Each of the pyrimidine base can exist in a number of tautomeric forms. Draw all other tautomers of cytosine and uracil.



cytosine

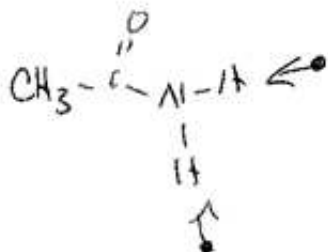


uracil



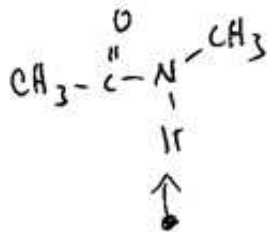
(5)

9. (10 pts) Consider the three amides. Which has the highest boiling point? Which will be the lowest? Explain this trend.



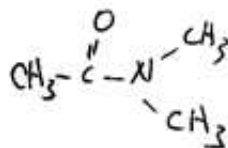
can have 2
hydrogen bonds

highest bp



can have 1
hydrogen bond

intermediate pb



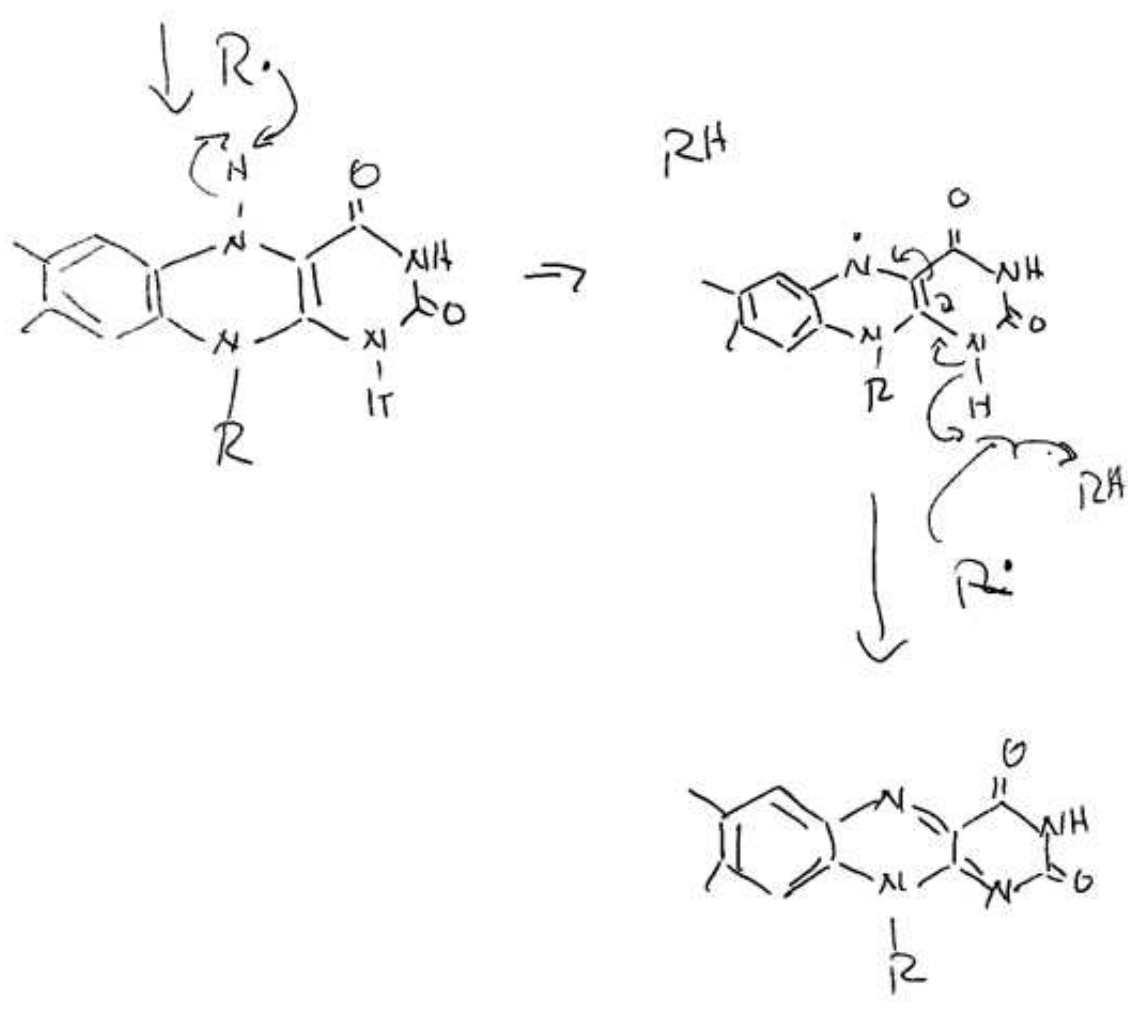
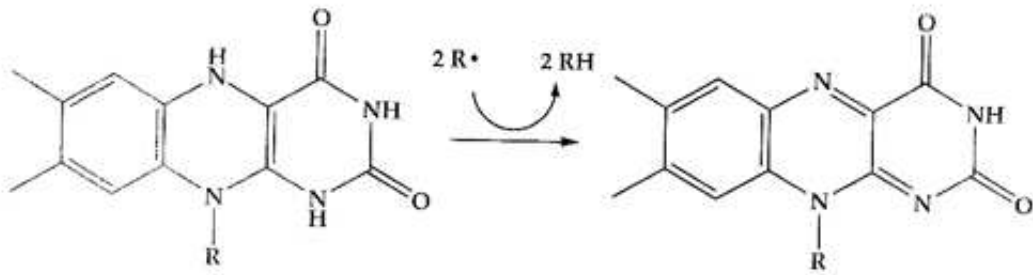
can have 0
hydrogen
bonds

lowest bp

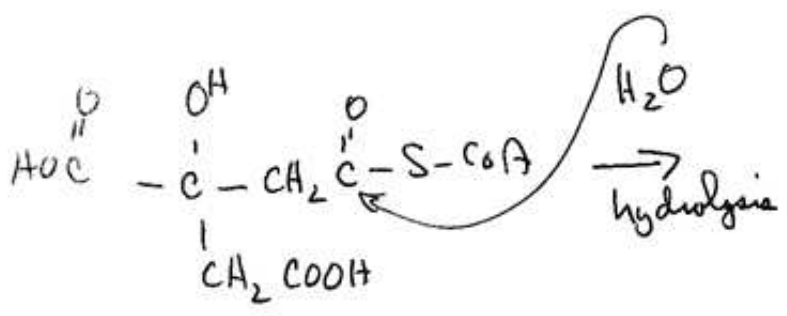
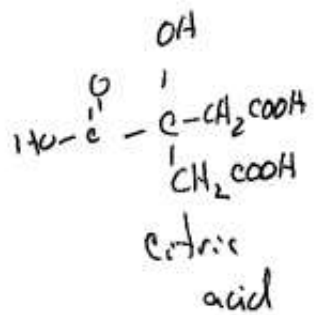
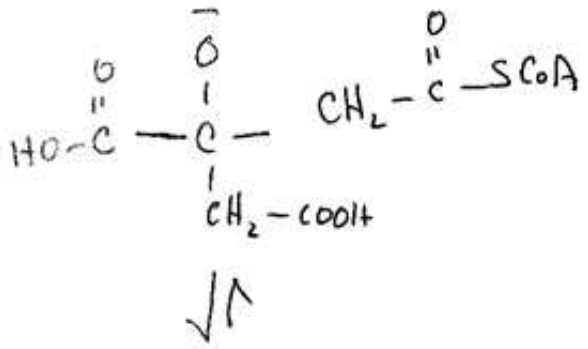
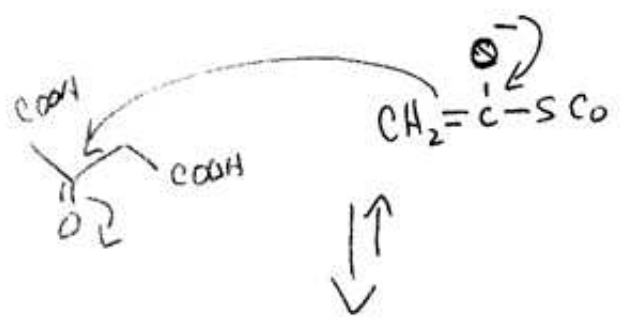
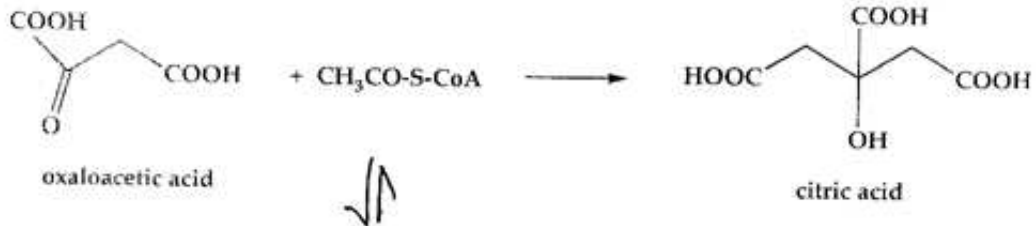
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10. (10 pts) The oxidation of FADH_2 to FAD can take place through radical intermediates. Write a mechanism for the reduction of two free radicals, $\text{R}\cdot$, by FADH_2 .

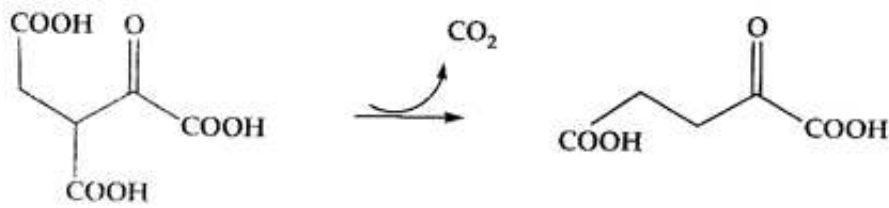


11. (10 pts) Write a mechanism for the formation of citric acid when acetyl-coenzyme A adds to oxaloacetic acid.

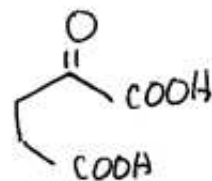


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12. (10 pts) Write a mechanism for the decarboxylation of the tricarboxylic acid to form α -keto glutaric acid.



✓



10

13. (10 pts) Write a mechanism for the phosphorylation of ADP by phosphoenolpyruvate.

