Study Guide #4

Cope and Claisen Rearrangements

Exam 3 Study Guide has been posted.

Covers Chapters 18,19,20 and 21

CHE 322 Study Guide **Exam 3** **Spring 2009**

The exam will cover Chapters 18, 19, 20, and 21. Exam questions are based largely on Workshops, in class Quiz Questions and the posted Problems of the Day.

Chapter 18 Carboxylic Acids and their Derivatives

1. Know basic nomenclature of each of the derivatives, acid chloride, anhydride, amide and ester.
2. Know about factors determining relative acidity. (Much of this is from CHE 321.)
3. Know the relative reactivity of the various functional groups. How can you prepare one from another? Know the basic mechanisms of these interconversions.
4. Know about lactones and lactams.
5. Know how to make nitriles and know their hydrolysis.
6. Know about the decarboxylation of carboxylic acids with a β-carbonyl.

Chapter 19. β-Dicarbonyl Compounds

7. Know about the acidity of β-dicarbonyl compounds. Know approximate pk_a values.
8. Know the Claisen condensation and related reactions. Know how to carry the reaction through to the loss of CO_2.
9. Know how to apply the acetoacetic acid synthesis to give a mono or disubstituted acetone.
10. Know how to apply the malonic ester synthesis to give a mono or disubstituted acetic acid.
11. Know the Mannich Reaction and how to use it to prepare a β-amino carbonyl compound.

Chapter 20. Amines

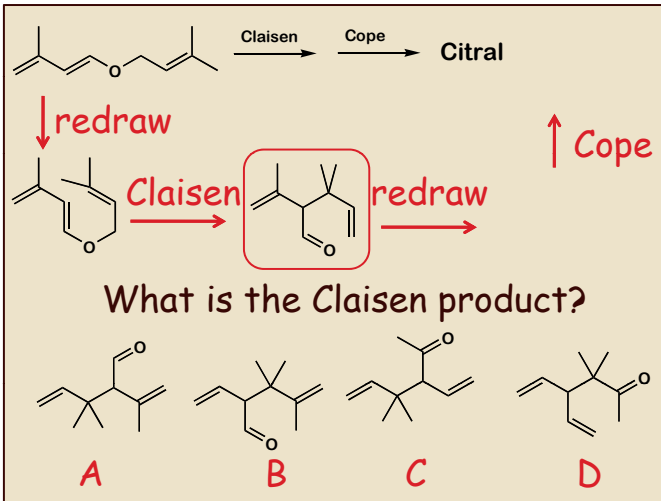
12. Know all about the relative basicity of different amines.
13. Know how to separate mixtures of amines and/or acids using extraction techniques.
14. Know the various methods and limitations of amine synthesis.
15. Know the Homann and Curtius rearrangements
16. Know how to form a diazonium salt and its reactivity.
17. Know how to use diazonium salts in aromatic substitution reactions.
18. Know the Cope and Hofmann eliminations.

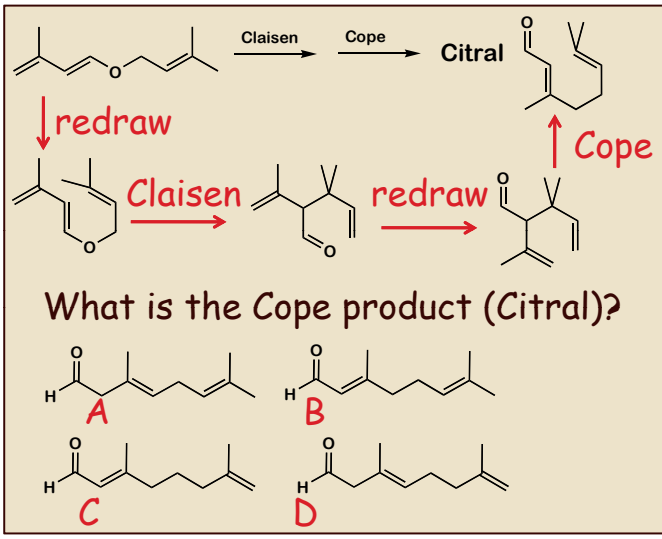
Chapter 21. Phenols and Aryl Halides

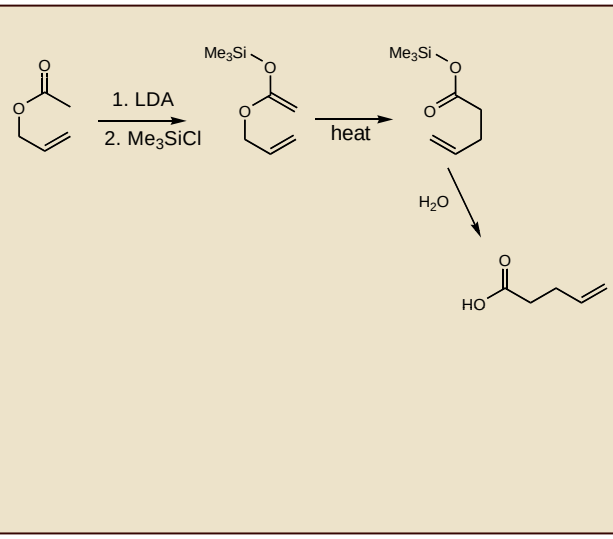
19. Know about the acidity of phenols. Know approximate pk_a values.
20. Know how to separate mixtures of phenols and/or acids and/or bases using extraction techniques..
21. Know how to use phenols to form ethers and how a phenol ether undergoes hydrolysis..
22. Know about quinones and hydroquinones
23. Know about the special nucleophilic aromatic substitution reactions or aryl halides
24. Know your benzyne chemistry.
25. Know all about the Claisen and Cope rearrangements. Work all the problems on the Study Guide. Be glad to know that the problems on the Study Guide are harder than the problems on the exam..

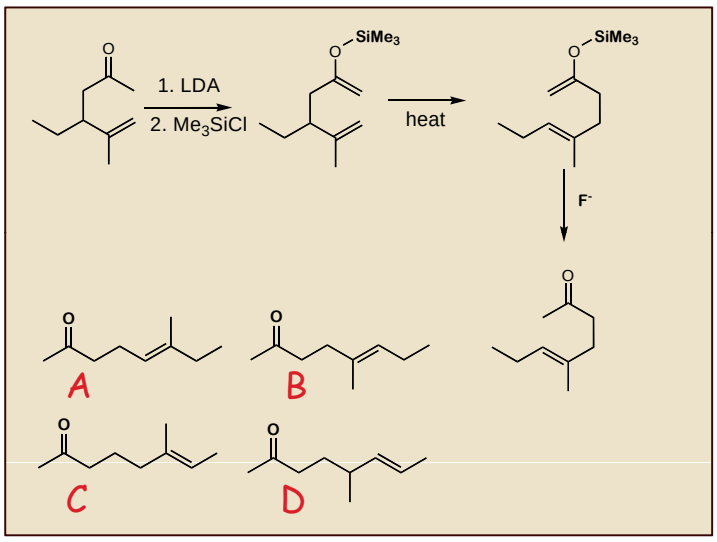
Final Notes.

Synthesis is an important part of this exam. Make sure you know how to do the synthesis problems form the workshop. All problems of the day since the last exam are very useful study material.

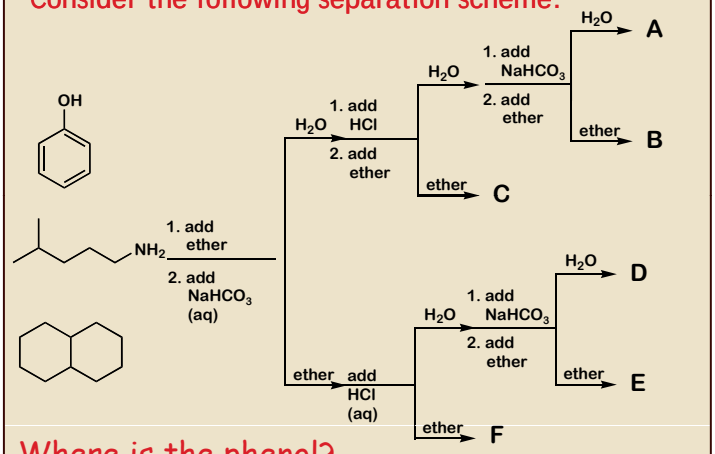






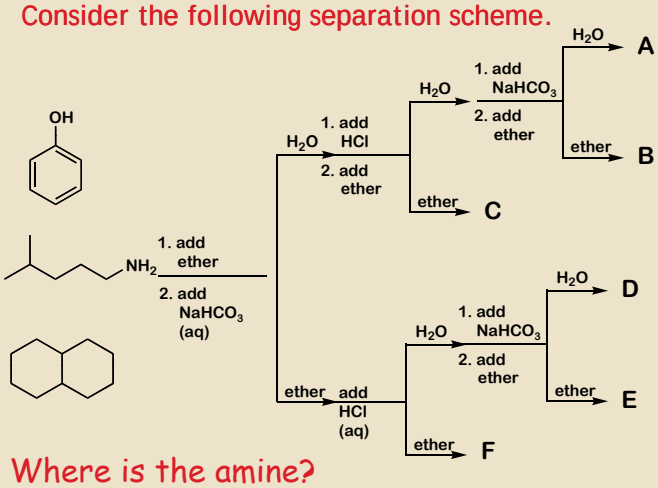


Consider the following separation scheme.



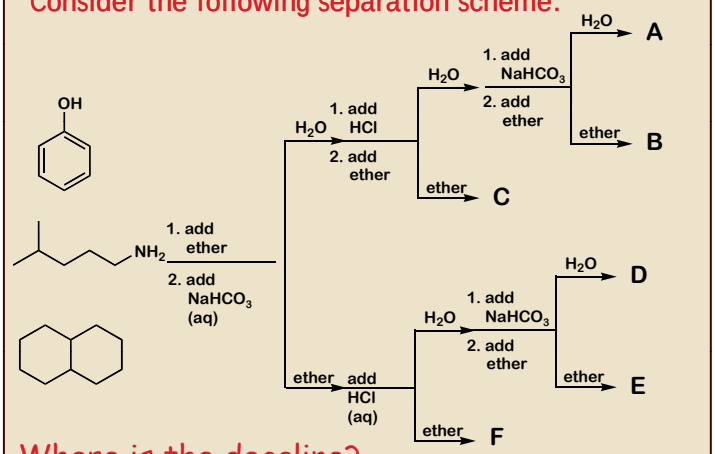
Where is the phenol?

Consider the following separation scheme.

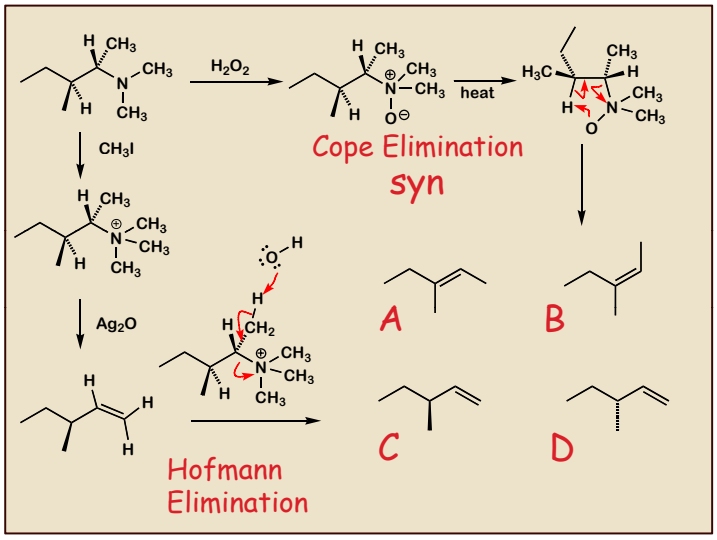


Where is the amine?

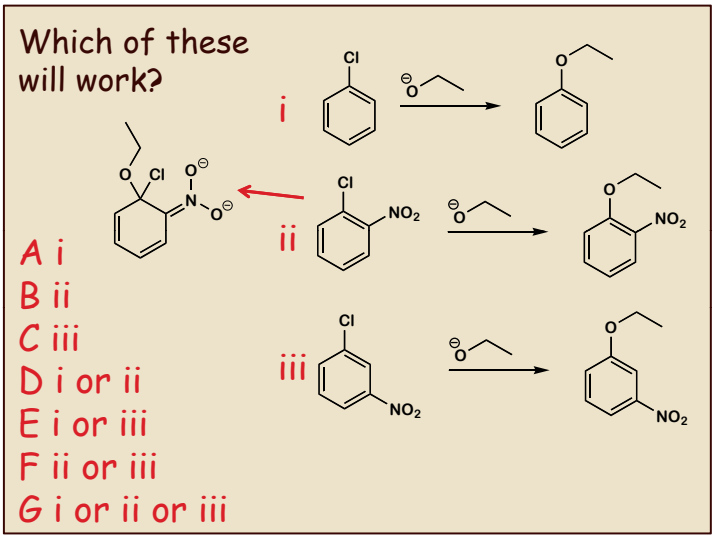
Consider the following separation scheme.



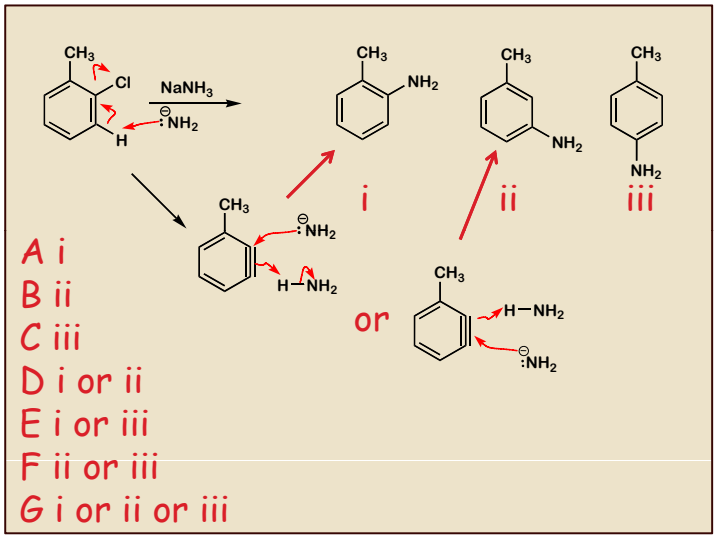
Where is the decaline?



Which of these will work?

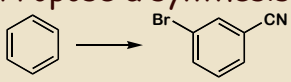


A i
B ii
C iii
D i or ii
E i or iii
F ii or iii
G i or ii or iii



A i
B ii
C iii
D i or ii
E i or iii
F ii or iii
G i or ii or iii

Propose a synthesis of the following compound



How many of these will work?

A 0
B 1
C 2
D 3
E 4

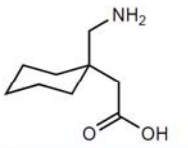
i. HNO_3, H_2SO_4 → H_2/Ni → Br_2, $FeBr_3$ → $NaNO_2$, H^+ → CuCN

ii. HNO_3, H_2SO_4 → Br_2, $FeBr_3$ → H_2/Ni → $NaNO_2$, H^+ → CuCN

iii. HNO_3, H_2SO_4 → H_2/Ni → $NaNO_2$, H^+ → CuCN → Br_2, $FeBr_3$

iv. Br_2, $FeBr_3$ → HNO_3, H_2SO_4 → H_2/Ni → $NaNO_2$, H^+ → CuCN

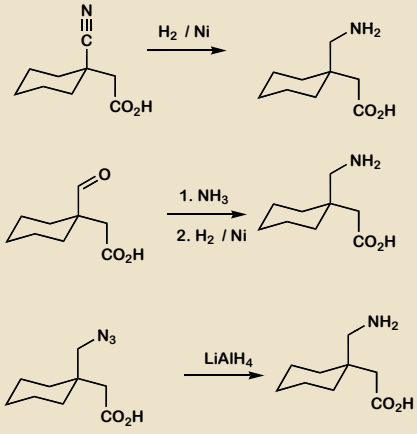
CHE 322 Problem of the Day



Gabapentin (brand name **Neurontin**) is a medication originally developed for the treatment of epilepsy. Presently, gabapentin is widely used to relieve pain, especially neuropathic pain. Gabapentin is well tolerated in most patients, has a relatively mild side-effect profile, and passes through the body unmetabolized.[1]

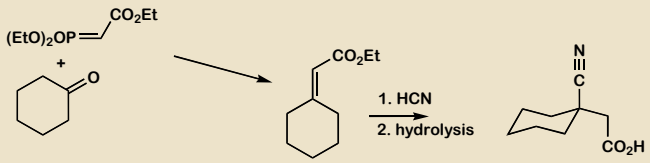
Propose a synthesis of gabpentin starting with cyclohexanone.

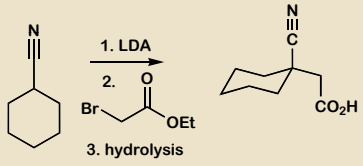
How can you introduce the amine as a last step?



How many of these will work?

A 0
B 1
C 2
D 3





How many of these will work?

A 0
B 1
C 2