

CHT 212
Final Examination

Rules for the examination

1. You may (and are encouraged to) consult your textbook, notes, and other references in print or electronically for conceptual information or for nomenclature assistance, but you are forbidden from searching for answers to specific questions on the exam.
2. You may consult professors or professional chemists regarding concepts, but you are forbidden from asking for help on specific problems.
3. You may not discuss this exam with the other students in the course.
4. This exam is due in my mailbox in the technology division by 8:00am on Friday, May 6. Please email me at mshevlin@ivytech.edu to let me know when you have completed the exam. The sooner you get it done, the sooner I can have it graded.
5. Please answer all questions on your own paper (where appropriate) and attach them to the exam. Please turn in a neat final draft of your answers rather than scratch work or answers with excessive revisions.
6. If you have any questions about the exam, please do not hesitate to contact me.

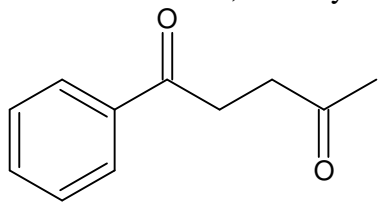
1. Compare and contrast the following four reactions. In your answer, consider the nature of the reaction (addition or substitution) and the nature of the nucleophile in each case.

- Ethanal reacts with cyanide ions to form a cyanohydrin
- Ethyl acetate reacts with cyanide ions to form an α -ketonitrile
- Ethanal reacts in base to form an aldol
- Ethyl acetate reacts in base to form a β -keto ester

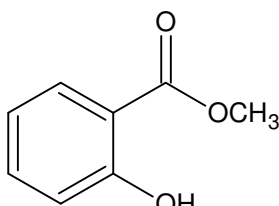
2. Propose a mechanism for the following reactions:

- Toluene reacts with 2-chloropropane in the presence of aluminum trichloride to form 4-isopropyltoluene (*p*-cymene)
- Acetic anhydride reacts with 1-aminopropane to form N-propylacetamide and acetic acid
- Two equivalents of ethyl propanoate react in the presence of sodium ethoxide to form ethyl 2-methyl-3-oxopentanoate

3. Propose syntheses of the following compounds, starting from benzene, toluene, alcohols of four carbons or fewer, and any necessary inorganic reagents.

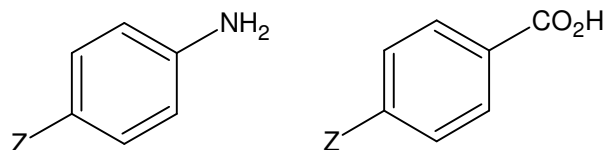


- a)
(hint: acetoacetic ester synthesis)



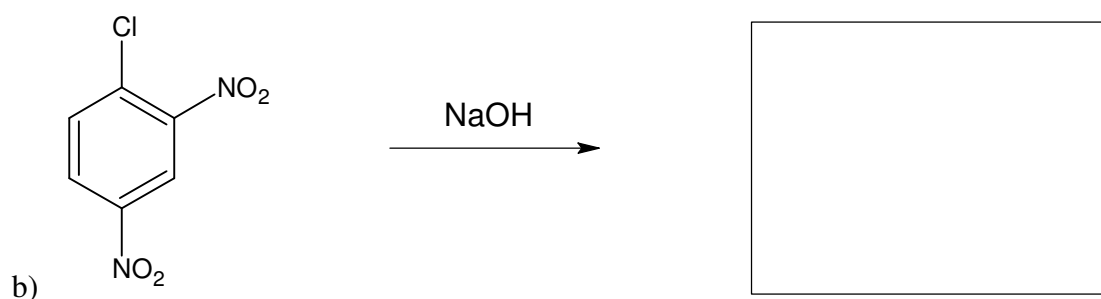
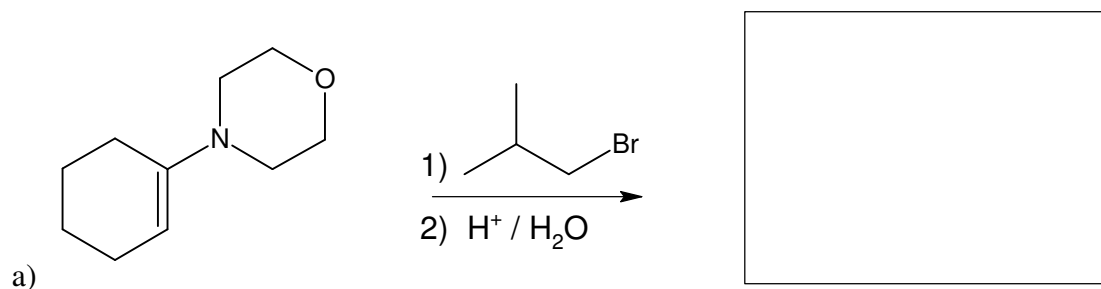
- b)
(hint: diazotization)

4. Consider *para*-substituted aromatic amines and carboxylic acids of the form

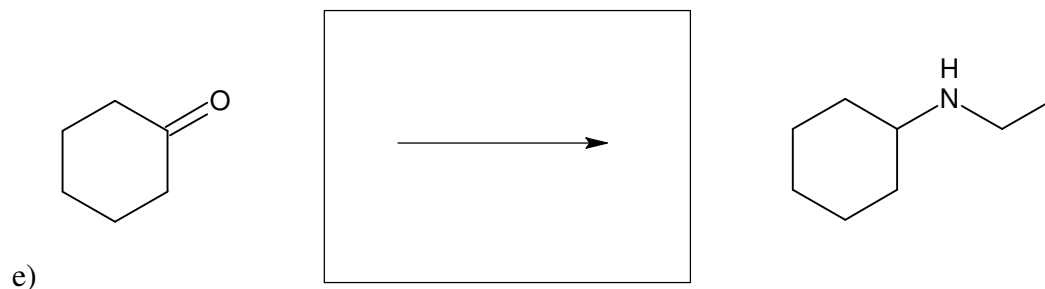
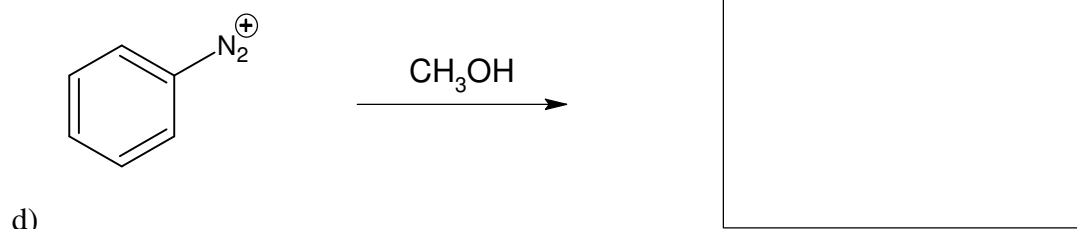
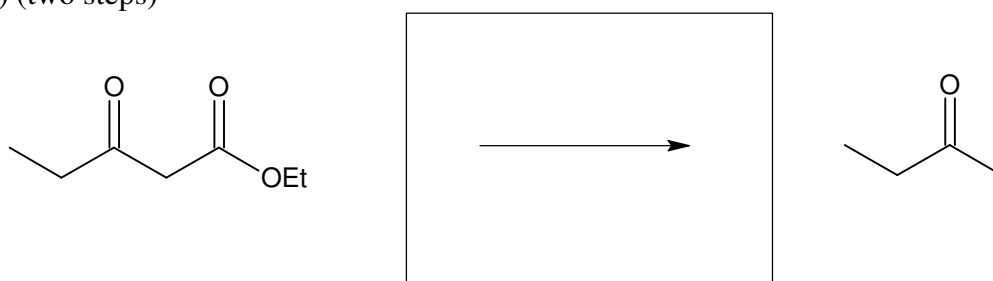


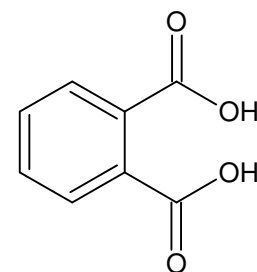
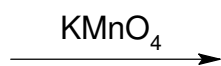
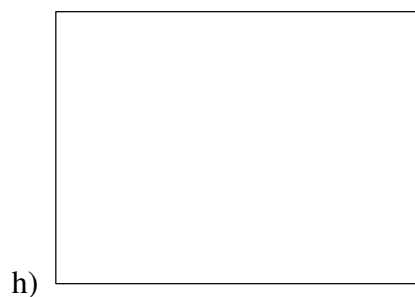
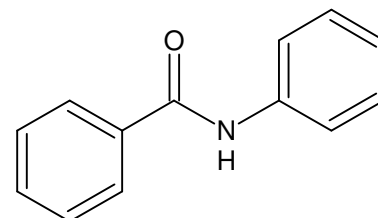
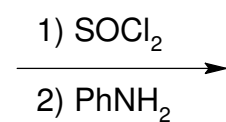
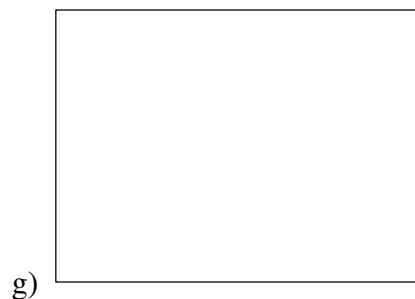
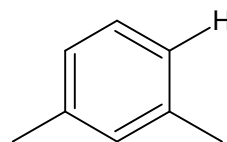
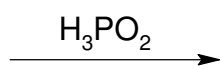
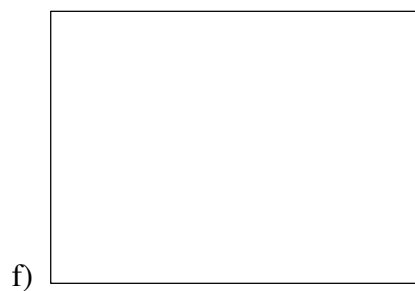
where Z is -OH, -CH₃, -H, -F, or -NO₂. Compare and contrast how the electron-donating and electron-withdrawing abilities of these groups affect the basicity of the amines and the acidity of the acids.

5. Fill in the appropriate starting material, reagents, or products as necessary. You may answer these questions on the exam itself.

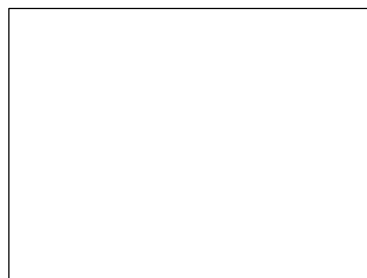
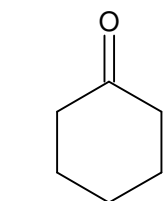
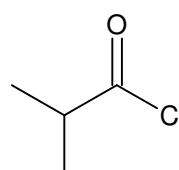
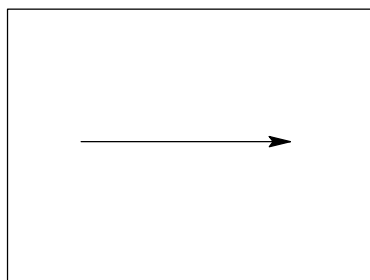
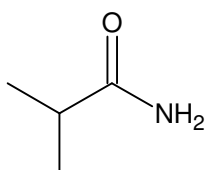


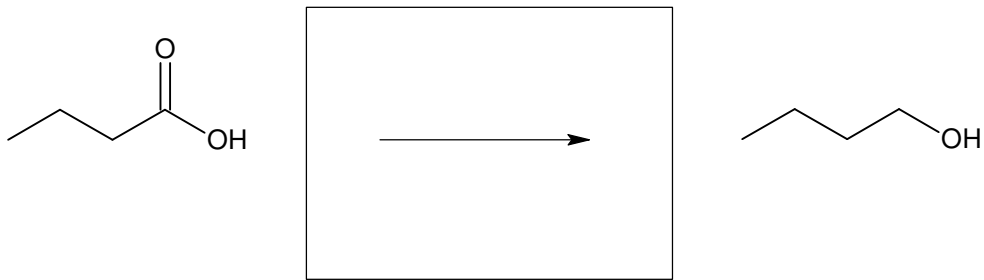
c) (two steps)



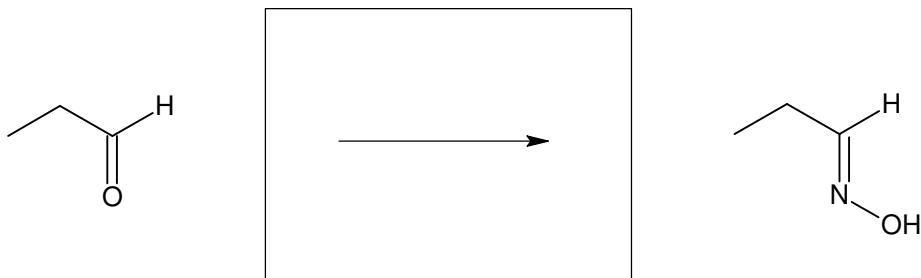


i) (two steps)

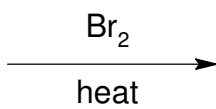
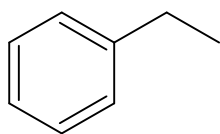




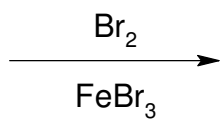
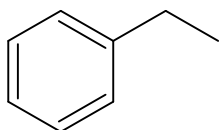
k)



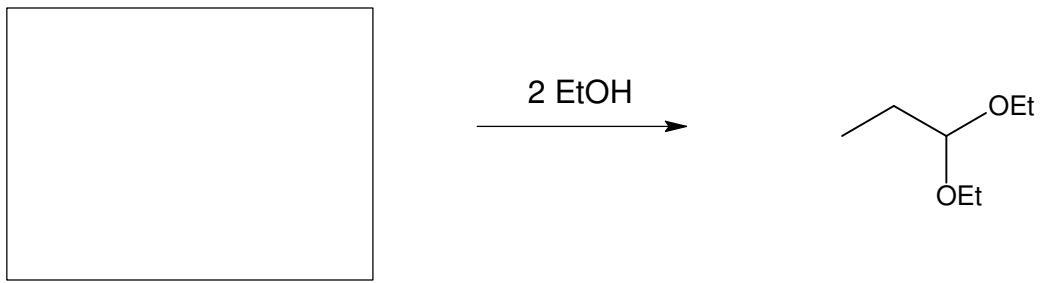
l)



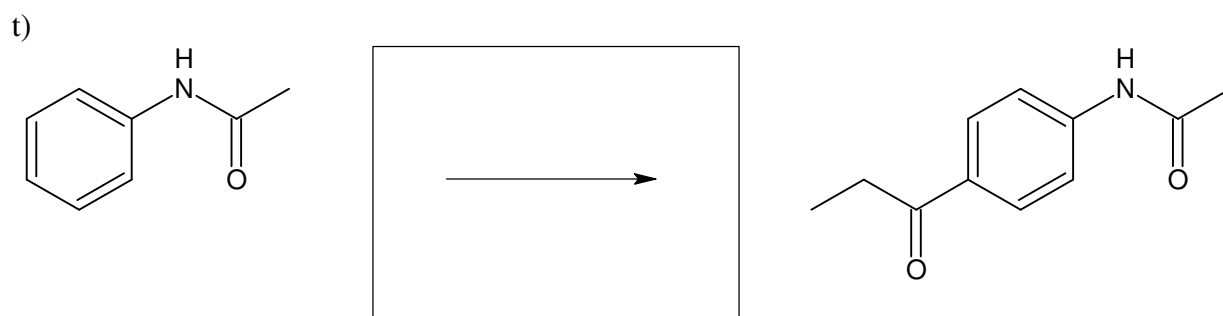
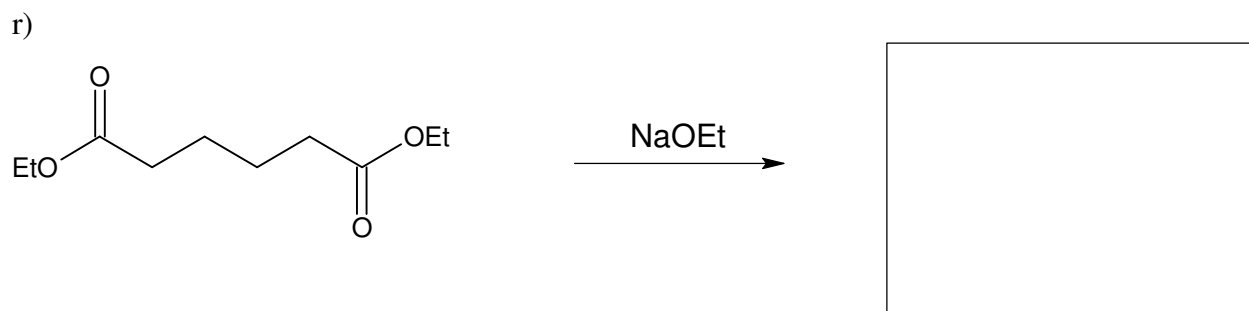
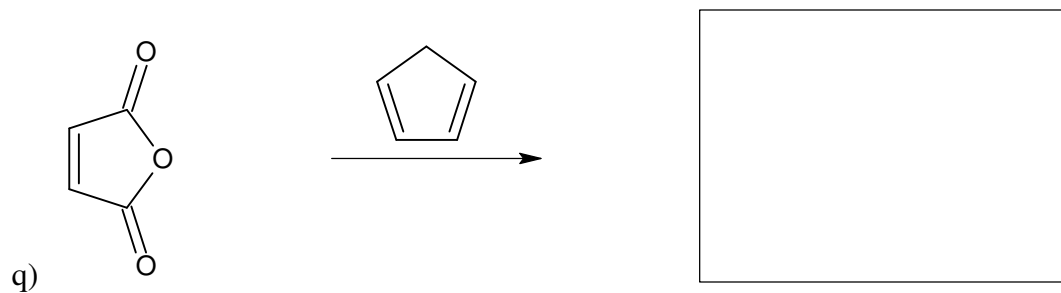
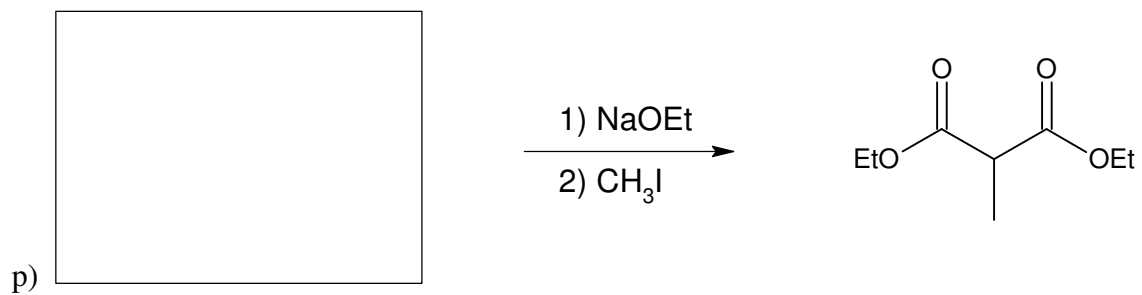
m)



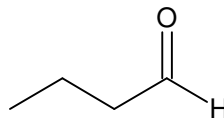
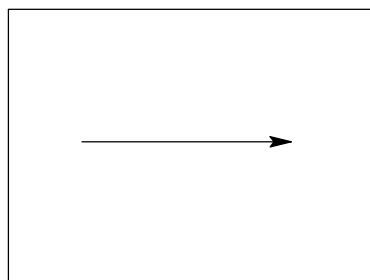
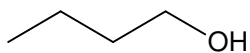
n)



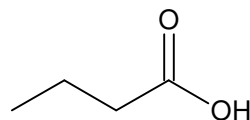
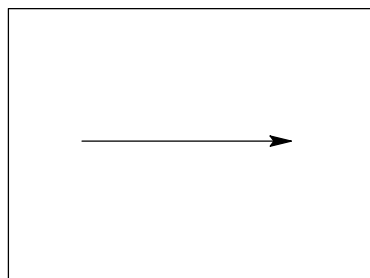
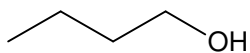
o)



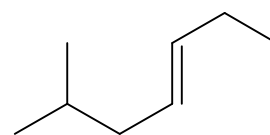
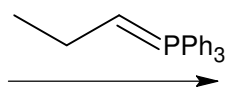
u)



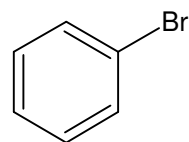
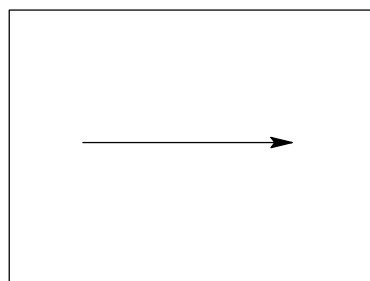
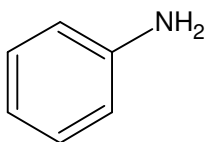
v)



w)



x) (two steps)



y)

