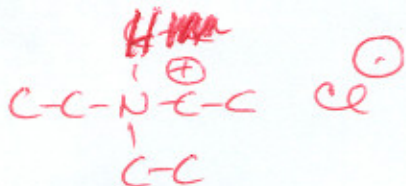
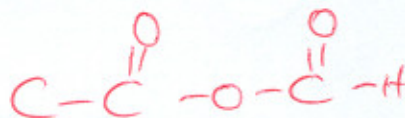


16 1. Give structures for each of the following compounds:

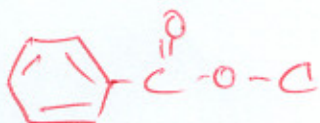
Triethyl ammonium chloride



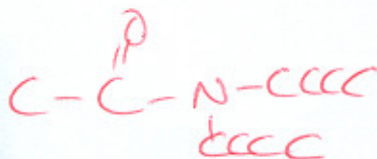
Acetic formic anhydride



Methyl benzoate ester



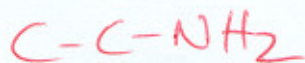
N,N-dibutylethanamide



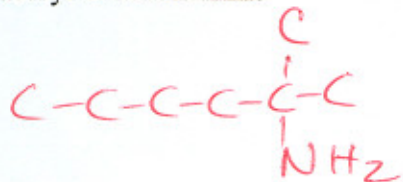
Propanenitrile



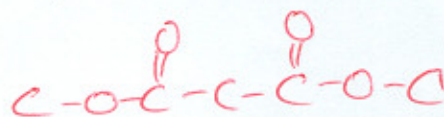
ethanamine



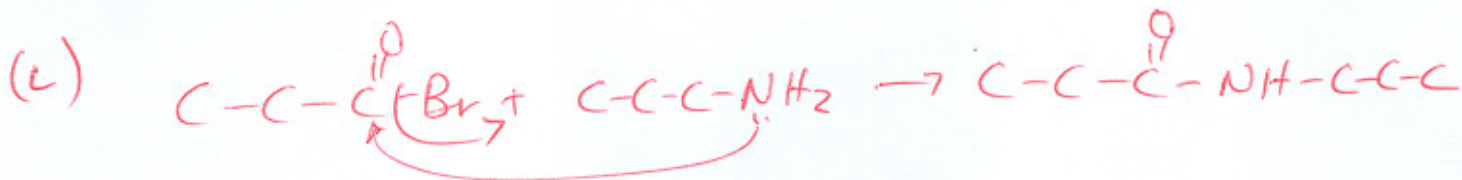
2-Methyl-2-hexanamine



Dimethylmalonate ester

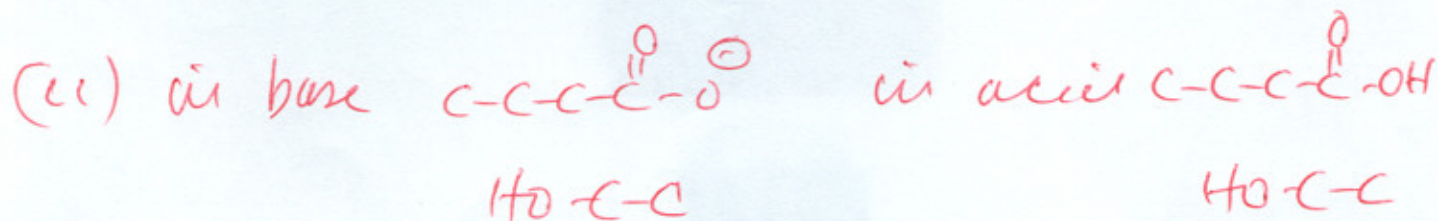
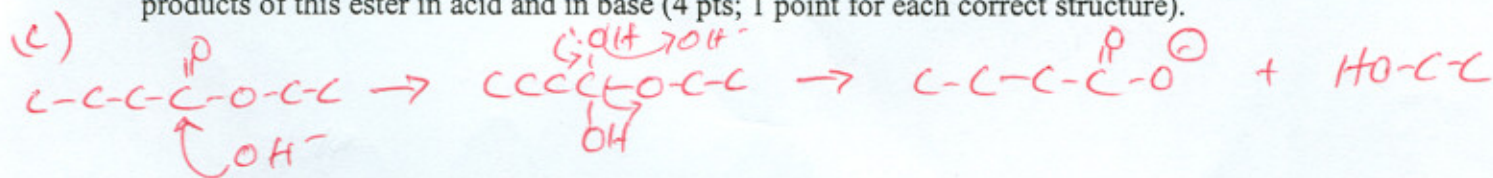


8 2. (i) Show the product(s) for reaction between propylamine and propanoyl bromide (6 pts). (ii) What is the name of this compound (2 pts)?

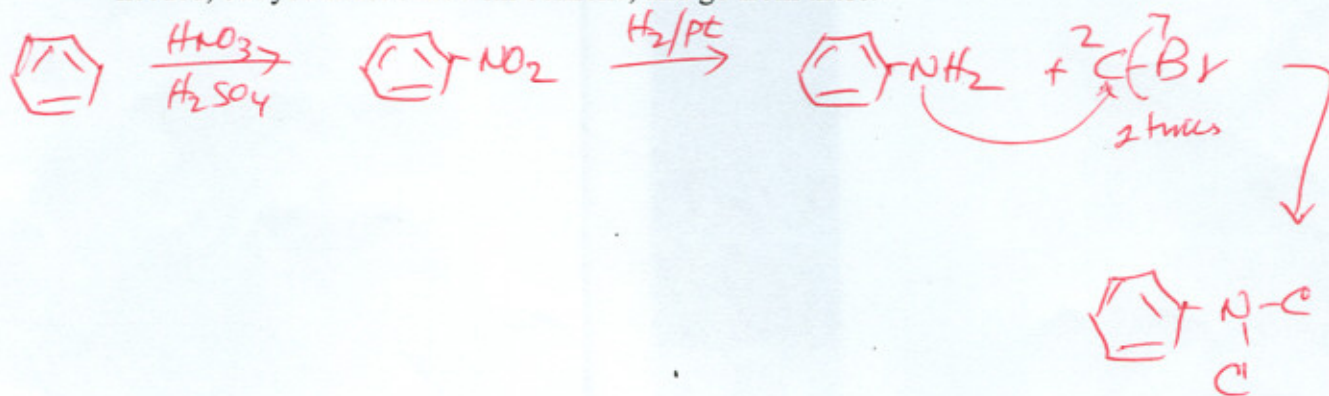


$\text{(c)} \quad \text{N-propyl propanamide}$

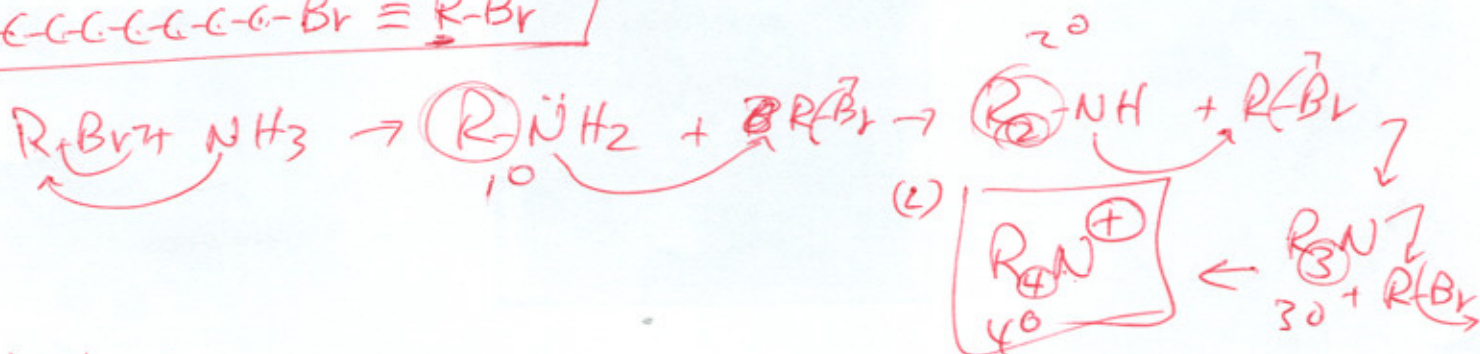
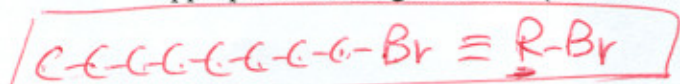
- 10 3. You can hydrolyze ethyl butanoate using either acid or base conditions. (i) Show the complete reaction mechanism, including a tetrahedral intermediate, for the base catalyzed (in presence of OH⁻ ion and water) hydrolysis (6 pts). (ii) Show the correct structures for the hydrolysis products of this ester in acid and in base (4 pts; 1 point for each correct structure).



- 10 4. Starting with benzene, show how you could produce N,N-dimethyl aniline. Use any reagents needed, but you must start with benzene, and go from there.

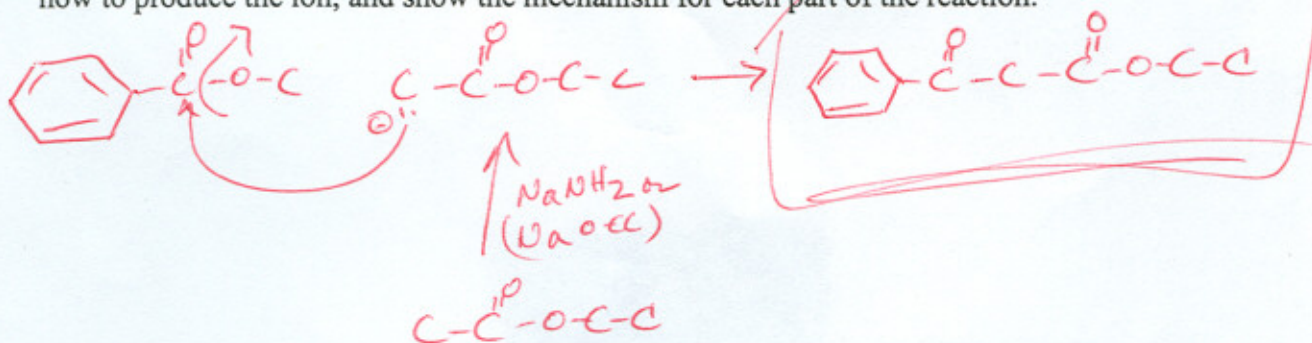


- 10 5. (i) Show how you would produce the tetraoctylammonium ion starting with ammonia and 1-bromooctane (5 pts). (ii) Explain how the tetraoctylammonium ion functions as a phase-transfer catalyst and how this catalyst could be used to catalyze the formation of pentanenitrile from appropriate starting materials (be sure to start with the correct alkyl halide).

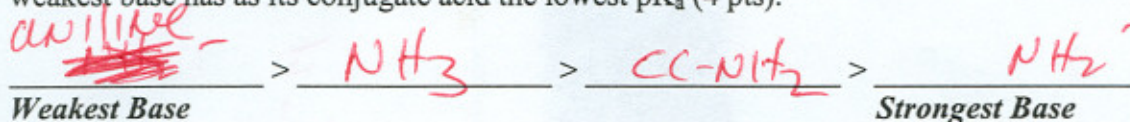


(c) the tetraalkyl ammonium ion is soluble in both aqueous and organic solvents - it shuttles ions from aq. to organic to react. $\text{C}-\text{C}-\text{C}-\text{C}-\text{Br} + \text{CN}^- \rightarrow \text{C}-\text{C}-\text{C}-\text{C}-\text{CN}$

- 10 6. Starting with ethyl acetate and methyl benzoate, show the reaction mechanism, and the major mixed Claisen condensation product for this reaction, which uses an ester enolate ion. Show how to produce the ion, and show the mechanism for each part of the reaction.

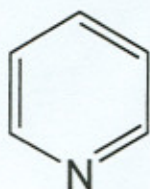


- 12 7. Rank the following compounds in order of increasing basicity (weakest to strongest). The weakest base has as its conjugate acid the lowest pK_a (4 pts).

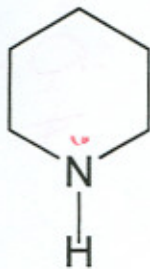


Ammonia, Aniline, Ethylamine, and amide ion (NH_2^-)

Which of the following compounds is the most basic, and why (4 pts)?



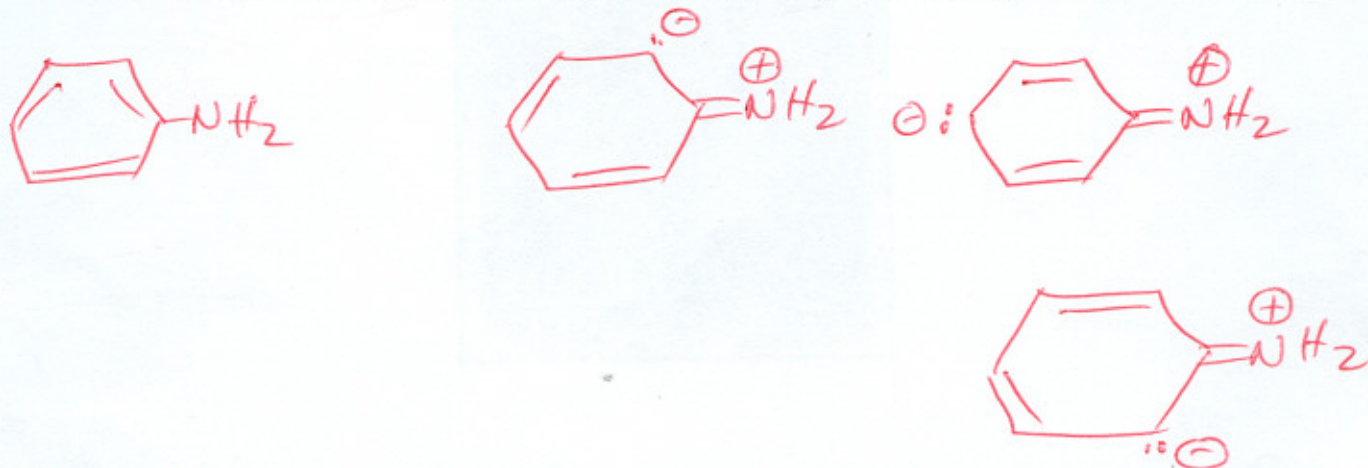
Pyridine



piperidine

Handwritten explanation: piperidine is most basic because its extra lone pair is always available to act as base.

Show the structure of aniline as you normal draw it. Then, show three additional resonance structures for aniline, which helps to explain some of its base properties (4 pts).



- 12 8. Show reactions required to prepare an amine from the starting materials listed below, using any other reagent necessary to produce an amine. The amine should have the number of carbons shown in each of the starting reactants.

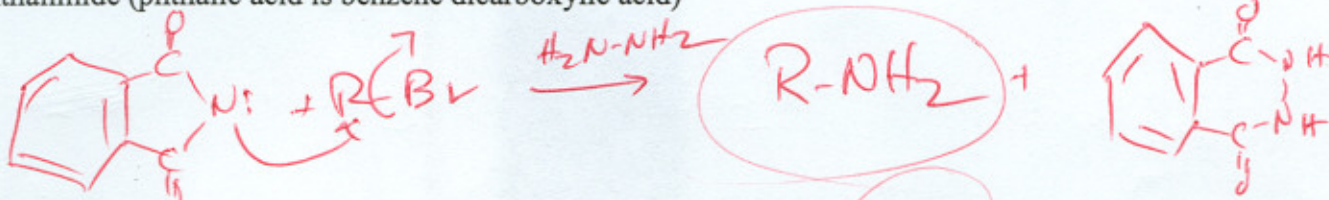
Propyl bromide



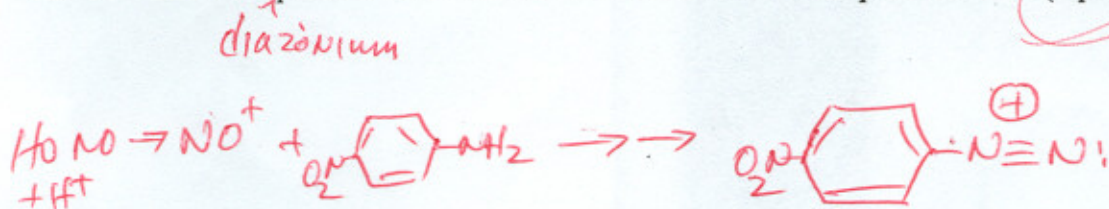
Nitrobenzene



Phthalimide (phthalic acid is benzene dicarboxylic acid)

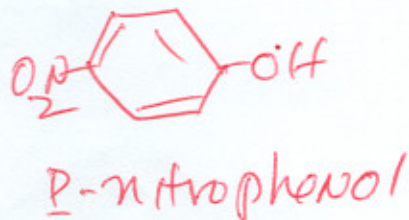


- 12 9. Show the product for reaction between nitrous acid and *p*-nitroaniline (4 pts).

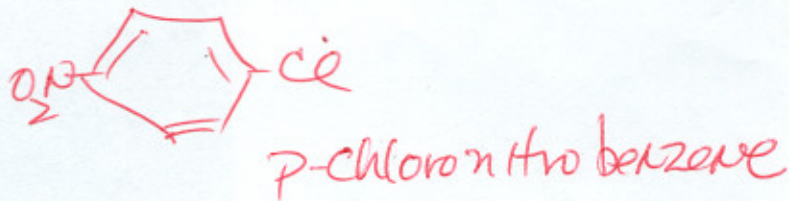


Show the reaction product, and its name, when each of the following chemicals reacts with the diazonium ion you just produced in the first part of problem #9 (2 pts).

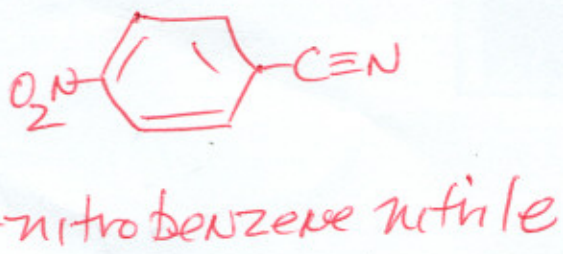
HOH



CuCl



CuCN



H₃PO₂

