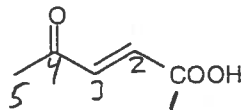


# EXAM 3, Sp '02

## A. Nomenclature (3 points each; 9 total points)

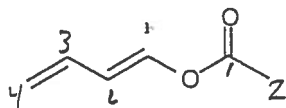
Please provide an acceptable name for each of the following compounds, noting stereochemistry where appropriate.

1.



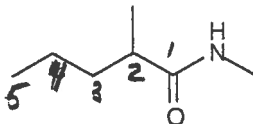
trans-4-oxo-2-pentenoic acid  
or  
E

2.



trans-1,3-butadienyl acetate  
or  
E  
or ethanoate

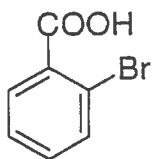
3.



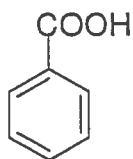
N,2-dimethylpentanamide

**B. Facts** (3 points each; 18 total points)

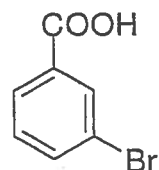
1. Rank the pKa value of the following benzoic acids from lowest (1) to highest (3). → *most acidic* ↑ ↓ *least acidic*



1

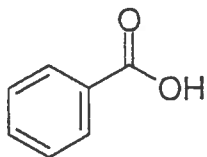


3

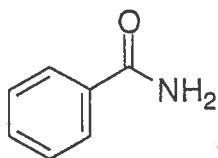


2

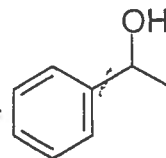
2. Rank the boiling points of the following molecules from lowest (1) to highest (3).



2

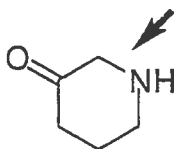


3

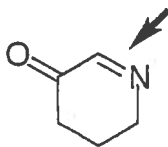


1

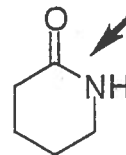
3. Rank the indicated C-N bond lengths from shortest (1) to longest (3).



3



1

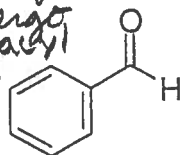


2

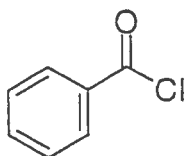
2

4. Rank these molecules from slowest (1) to fastest (3) in their rate of nucleophilic acyl substitution.

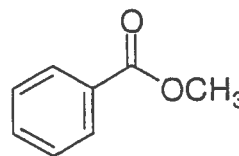
aldehydes do not  
undergo  
Nuc acyl  
subst.



1

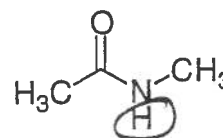
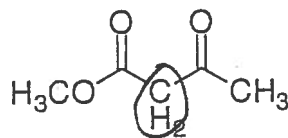
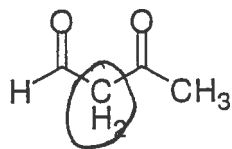


3

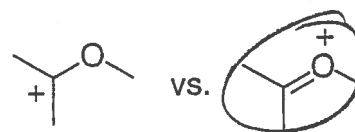
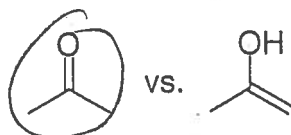
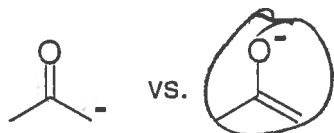


2

5. Circle only the most acidic hydrogen or hydrogens on each of the following molecules (i.e., one circle per molecule).



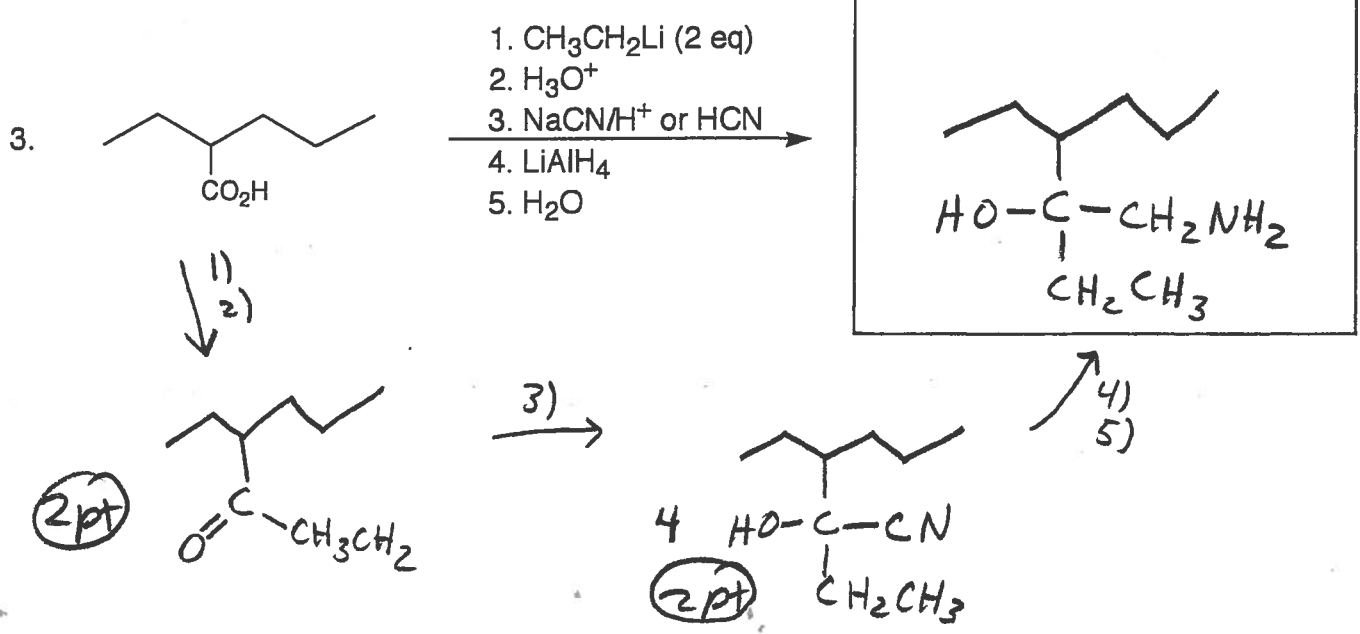
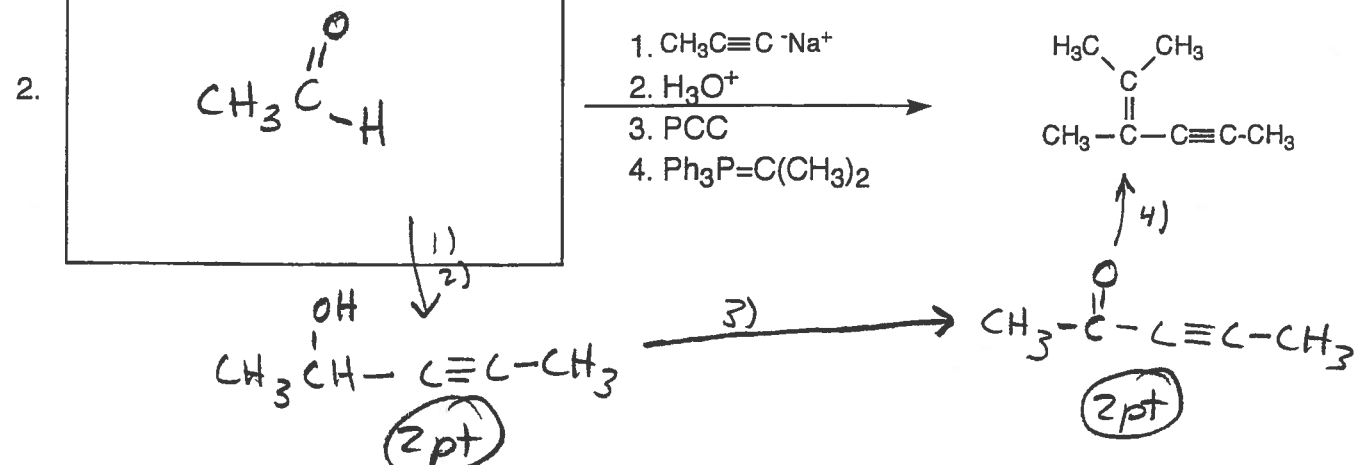
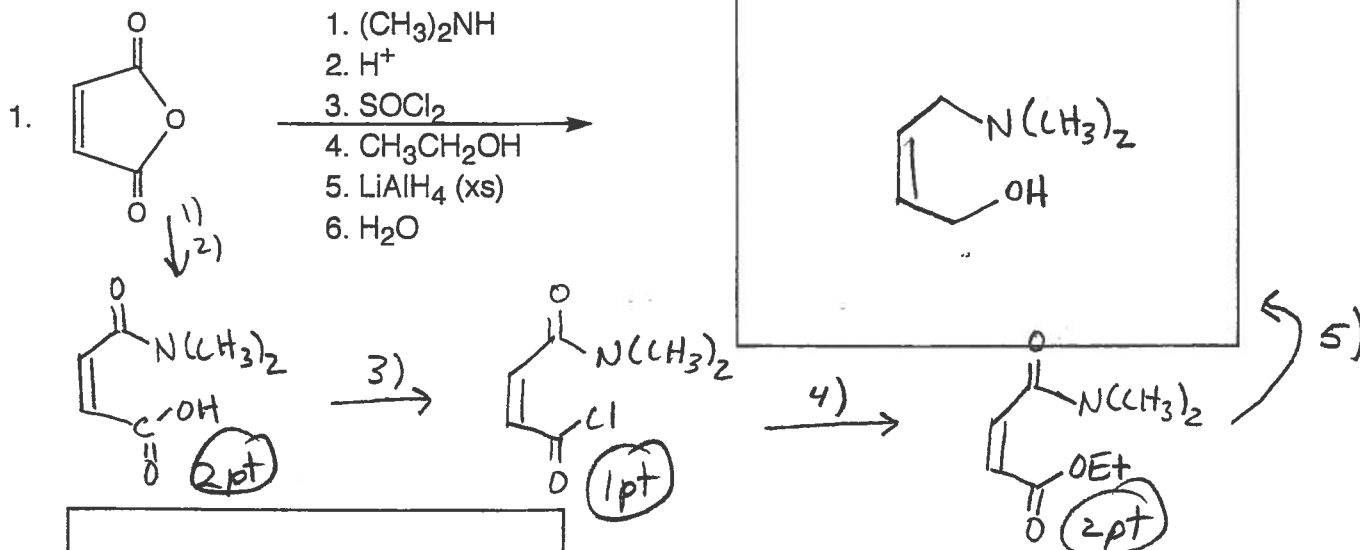
6. Circle the more stable structure in each of the following pairs (i.e., one circle for each pair of structures).



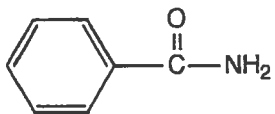
**C. Reactions:** Total = 30 points, 6 points each

Please provide the starting material, the reagents, or major product in the answer box.

Be sure your drawing indicates stereochemistry if applicable. Partial credit is awarded only when intermediate products are shown below the reaction.



4.

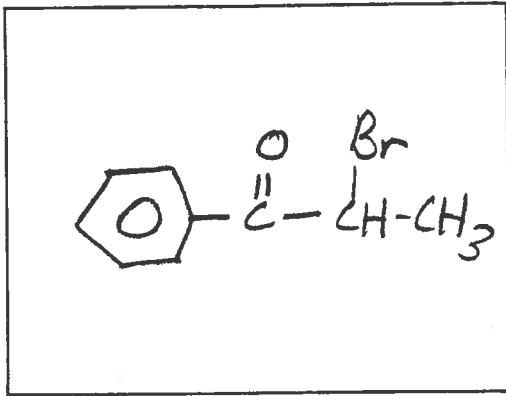


1)



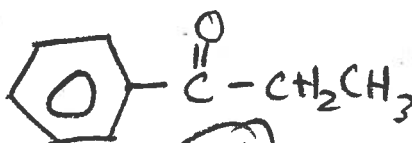
(2pt)

1. SOCl<sub>2</sub> or POCl<sub>3</sub>
2. CH<sub>3</sub>CH<sub>2</sub>MgBr
3. H<sub>3</sub>O<sup>+</sup>
4. Br<sub>2</sub>/acetic acid



2)

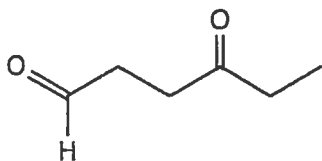
3)



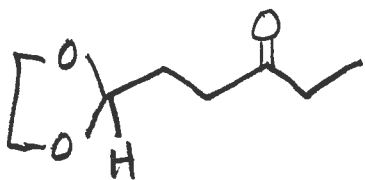
(2pt)

4)

5.



HO<sup>-</sup> / H<sup>+</sup>



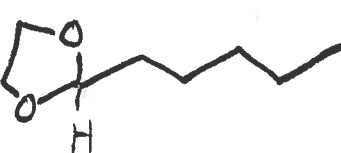
(2pt) 1. HO<sup>-</sup> / H<sup>+</sup>

(2pt) 2. NH<sub>2</sub>NH<sub>2</sub> or 2. NH<sub>2</sub>NH<sub>2</sub> / KOH / Δ (2pt)

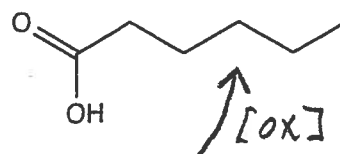
(1pt) 3. KOH / Δ

(1pt) 4. H<sub>3</sub>O<sup>+</sup>

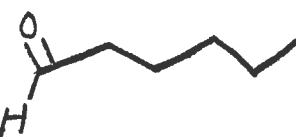
1) NH<sub>2</sub>NH<sub>2</sub>  
2) KOH / Δ



- cannot use Clemmensen!



[ox]

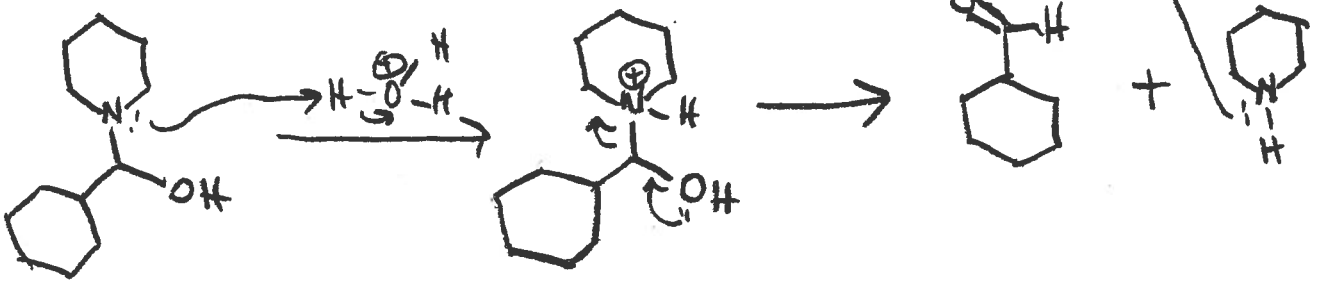
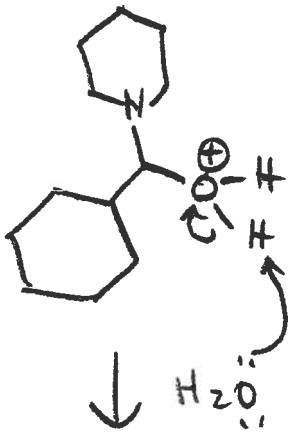
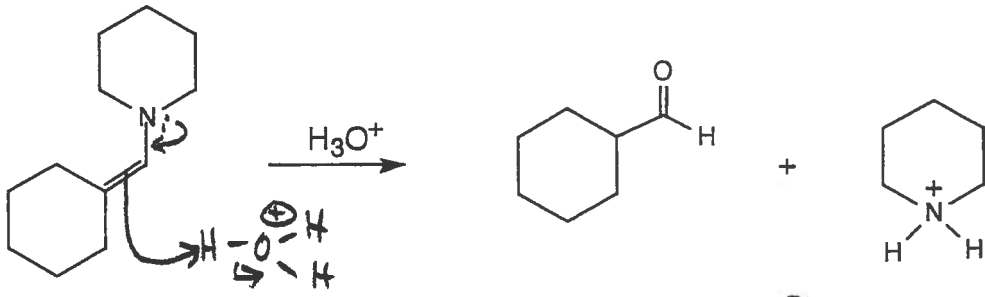


H<sub>3</sub>O<sup>+</sup>



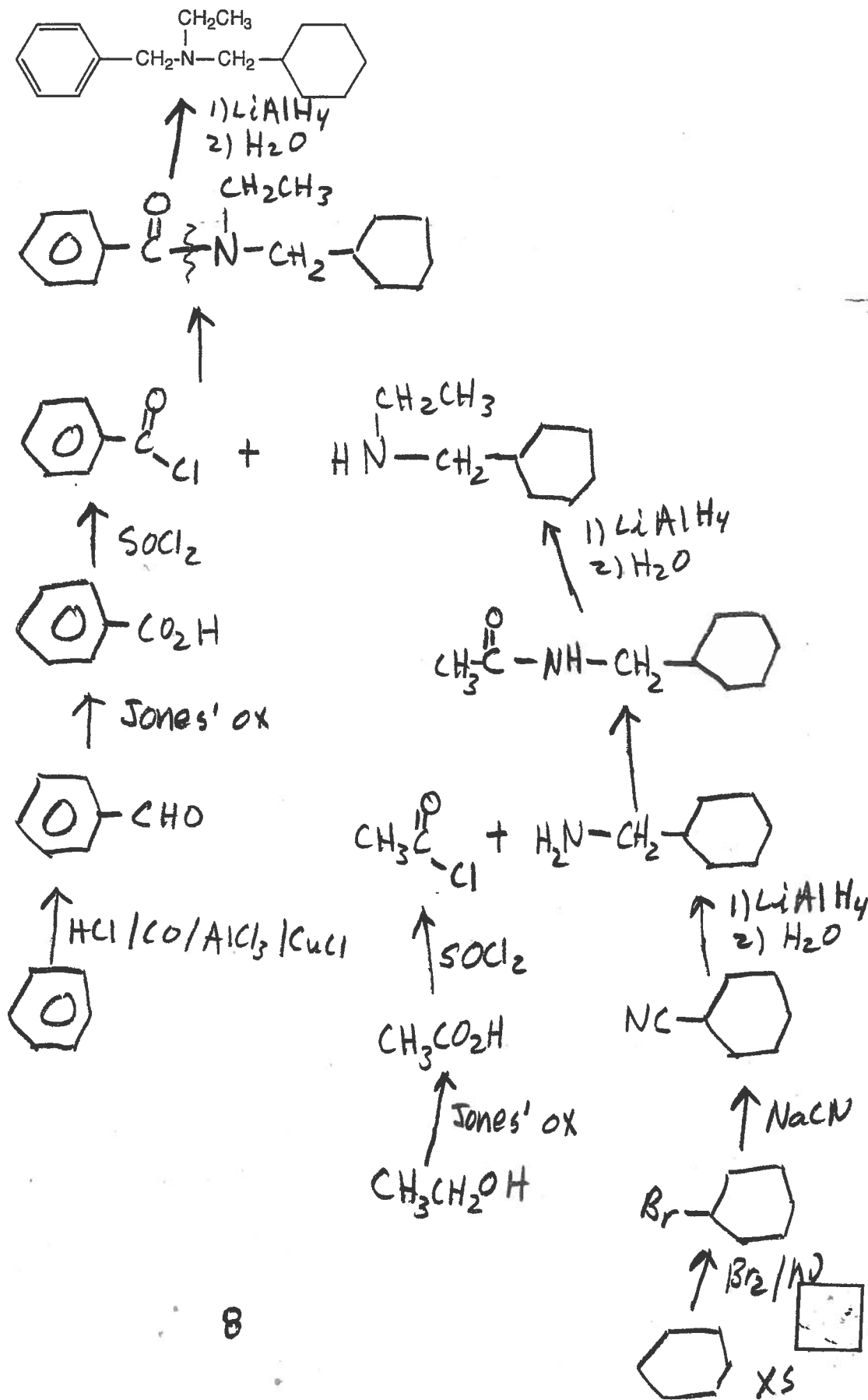


2.



**E. Synthesis: 15 Points**

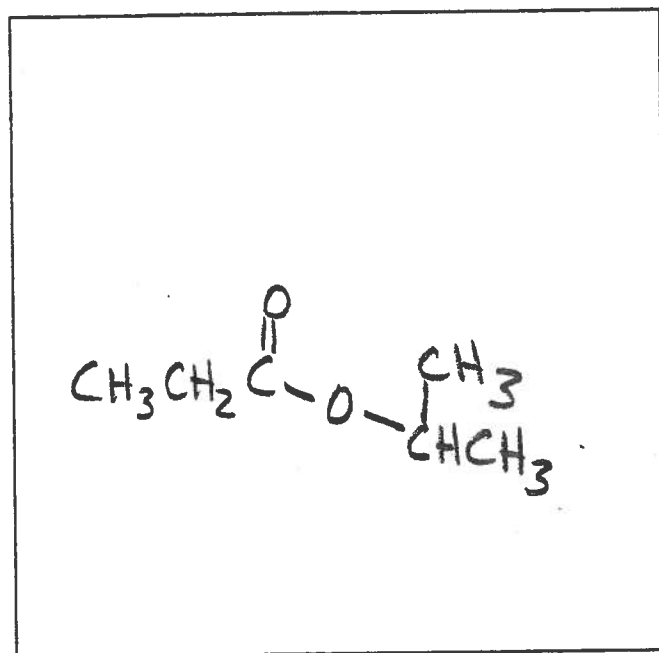
Synthesize the molecule below using any of the following reagents: benzene, cyclohexane, alcohols, alkanes, alkenes, and/or alkynes of **two carbons or less**, any inorganic reagents, any oxidizing or reducing agents, and any peroxyacids.





F. Spectroscopy: 10 Points

A compound with the formula  $C_6H_{12}O_2$  exhibits the IR,  $^1H$  NMR, and proton-decoupled  $^{13}C$  NMR spectra shown on the following page. Please identify this compound and draw the structure in the box provided below.



ester + 3

isolated Et + 2

isolated iPr + 3

(for  $-C(=O)-$  other than ester, only +1)

