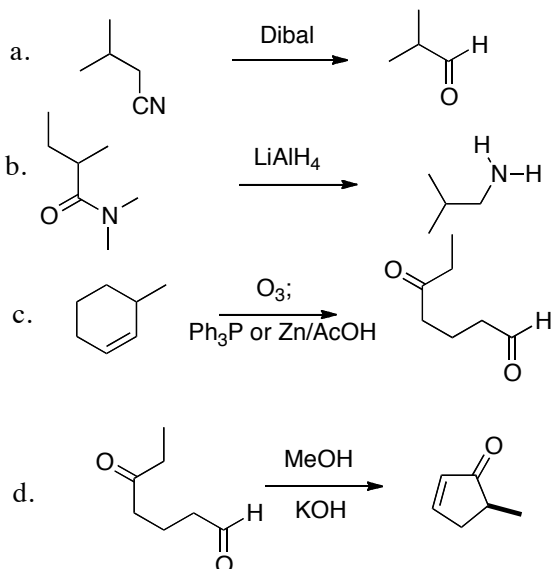
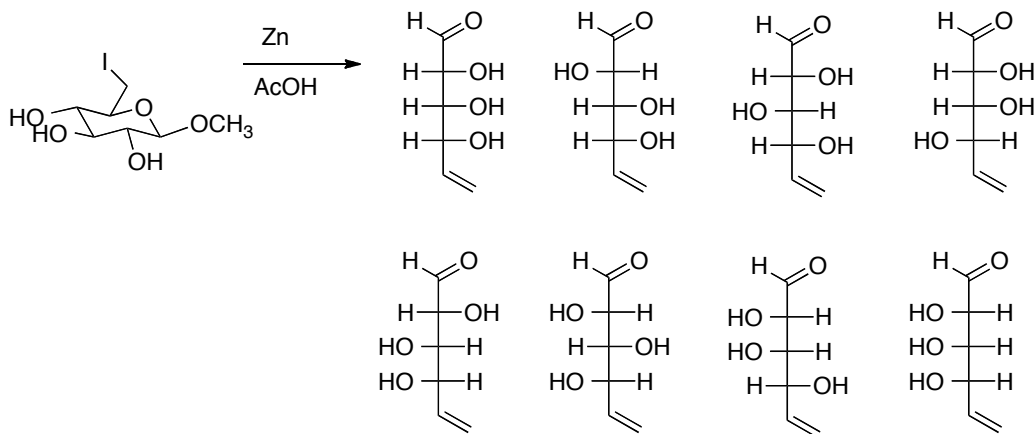


This is an open-book, open notes exam.

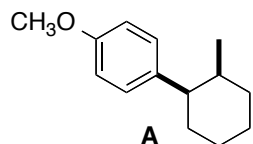
1. (20 points) The reactions shown would not proceed as indicated. Draw the actual products. You do not need to draw mechanisms.



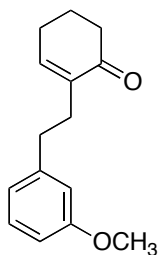
2. (20 points) Circle the expected product. For each stereogenic center in the starting material, write a note saying whether the absolute configuration is inverted or unchanged.



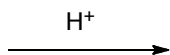
3. (20 points) Outline a synthesis of **A** using only starting materials that contribute three or fewer carbons to the final product, and a monosubstituted benzene that contributes seven or fewer carbons to the final product. Stereochemistry is not important.



4. (20 points) Deduce the structure of **C**, and draw an arrow-pushing mechanism for its formation. Stereochemistry is not important.



B



C $C_{15}H_{18}O_2$

MS m/z (%): 230 (M, 100), 213 (55), 187 (30), 160 (25)

IR: 1720, 1615 cm^{-1}

1H NMR:

7.23, d, $J = 8.9$ Hz, 1H
 6.75, dd, $J = 8.9, 3.1$ Hz, 1H
 6.66, d, $J = 3.1$ Hz, 1H
 3.78, s, 3H
 2.84, m, 2H
 2.73, dt, $J = 2.9, 12.2$ Hz, 1H
 2.61, m, 1H
 2.41-2.53, m, 2H
 2.35, dt, $J = 3.1, 12.2$ Hz, 1H
 2.18-2.30, m, 2H
 1.86, m, 1H
 1.61-1.77, m, 2H

^{13}C NMR

212.0, s
 157.8, s
 138.0, d
 138.0, s
 126.9, s
 113.8, d
 112.0, d
 55.2, q
 52.7, d
 44.3, d
 40.1, t
 30.5, t
 29.3, t
 26.3, t
 21.7, t

5. (20 points) Draw the letters on the product where they belong. Make a list of bonds formed and bonds broken, and draw the mechanism in detail.

