

CHEM 3371 (100), Spring 2017
 Professor Walba
 Second Hour Exam
 March 14, 2017

scores:

- 1) 20
 2) 20
 3) 20
 4) 20
 5) 20

100

CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

Signature: Key

Recitation TA Name: Ed Guzman

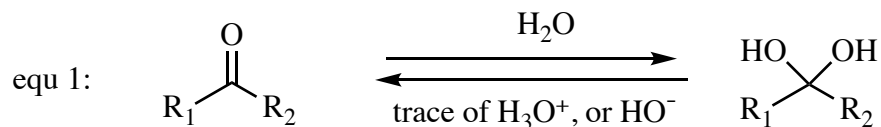
Recitation day and time: _____

This is a closed-book exam. The use of notes, calculators, scratch paper, or cell phones will not be allowed during the exam. You may use models brought in a clear Ziploc bag. Please put all your answers on the test in the appropriate place. Use the backs of the pages for scratch (there are two additional blank scratch sheets after the last page of the exam). DO NOT PUT ANSWERS ON THE SCRATCH SHEETS.

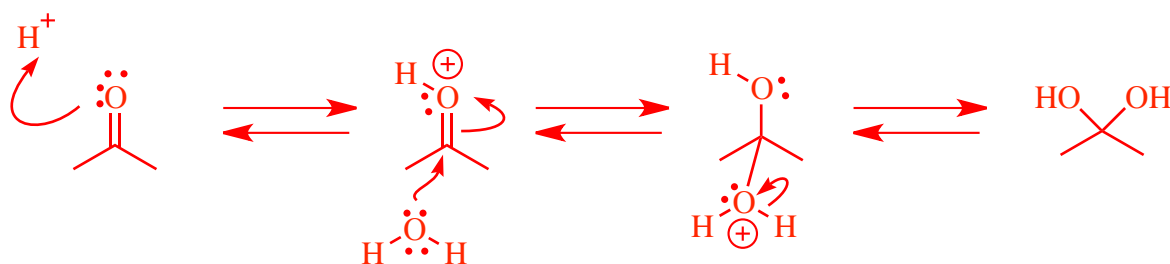
PLEASE read the questions very carefully!

Partial Periodic Table									
1A							8A		
1 H							2 He		
	2A	3A	4A	5A	6A	7A			
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne		
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar		
						35 Br			
						53 I			

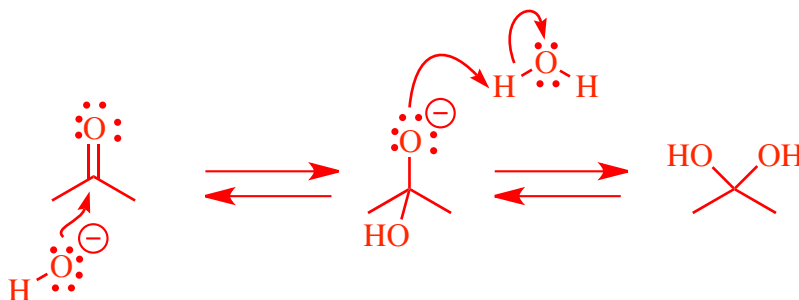
1 (20 pts) Carbonyl compounds react in water to give carbonyl hydrates, existing in equilibrium with the starting carbonyl compound, as indicated in equ 1 below, where R_1 and R_2 can be almost any group (not just alkyl):



a) Propose an arrow-pushing mechanism for the carbonyl – carbonyl hydrate equilibration occurring with a trace of H_3O^+ catalyst.

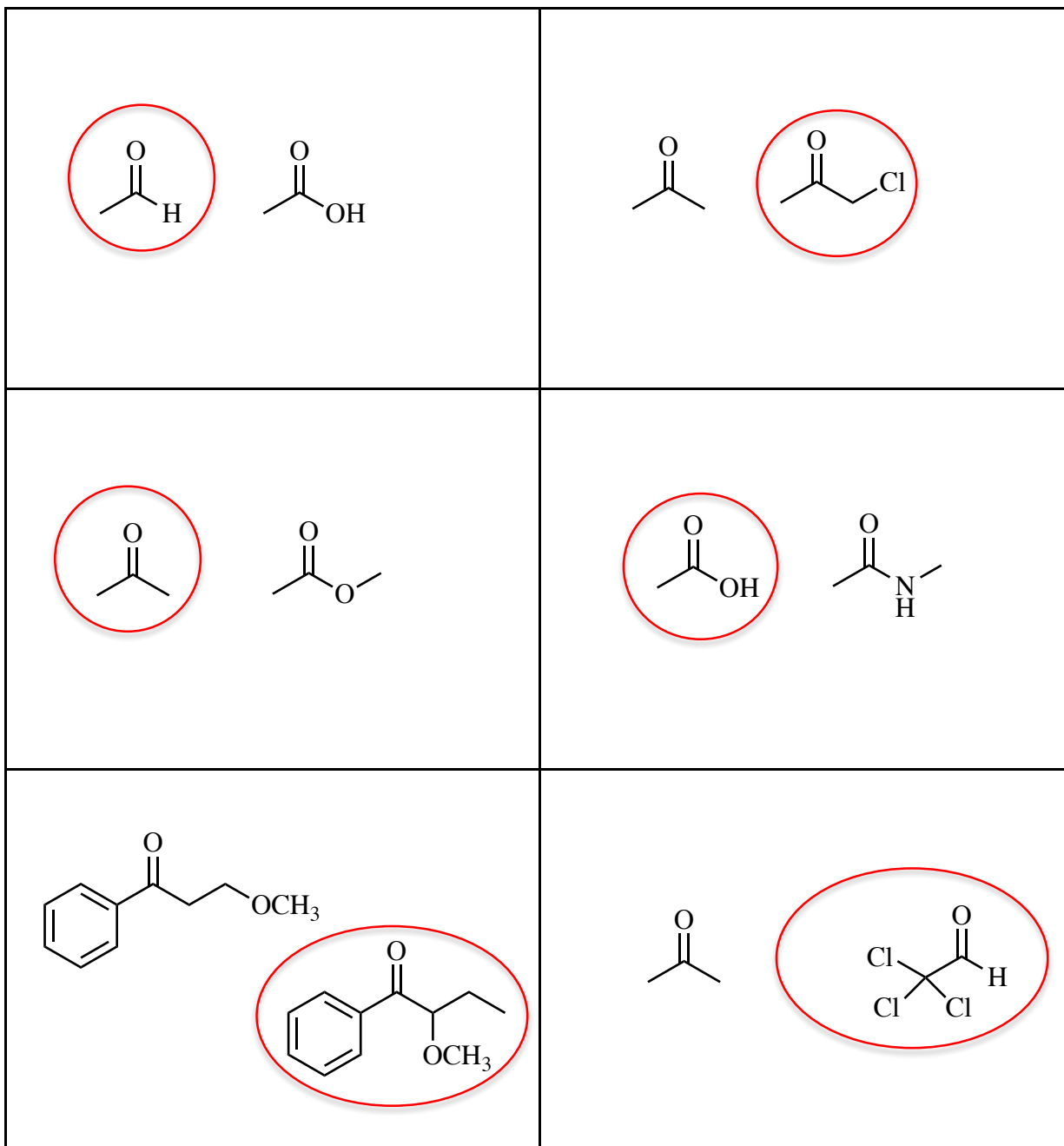


b) Propose an arrow-pushing mechanism for the carbonyl – carbonyl hydrate equilibration occurring with a trace of HO^- catalyst.

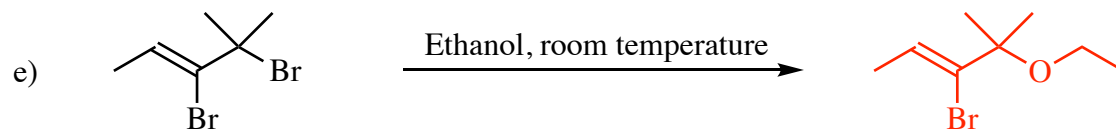
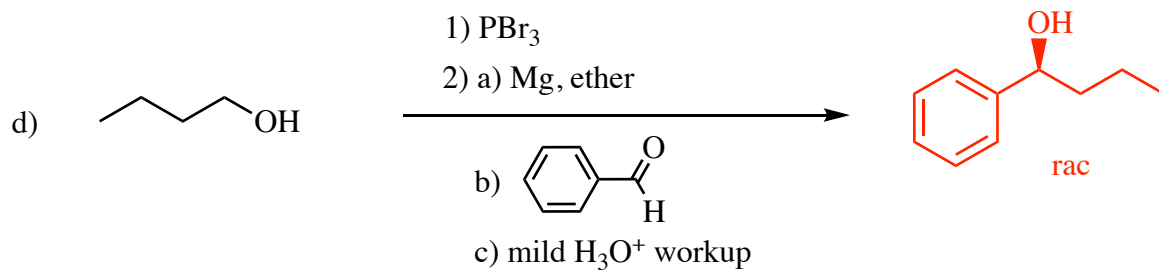
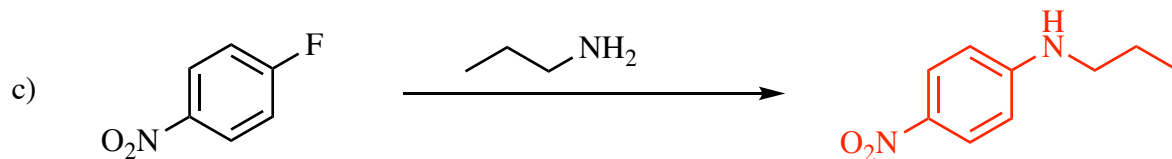
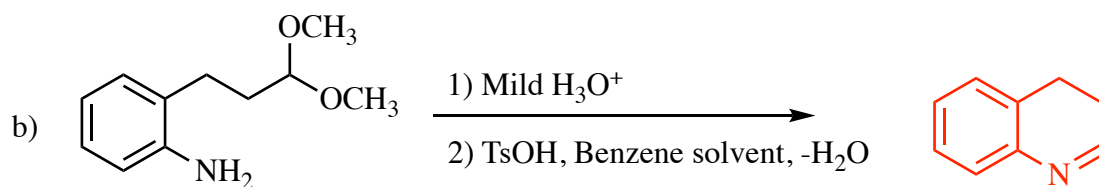
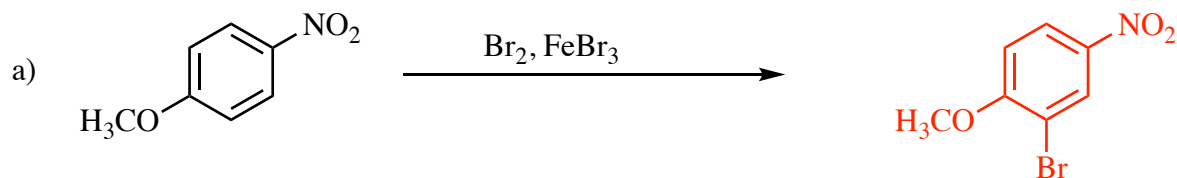


1. – Continued

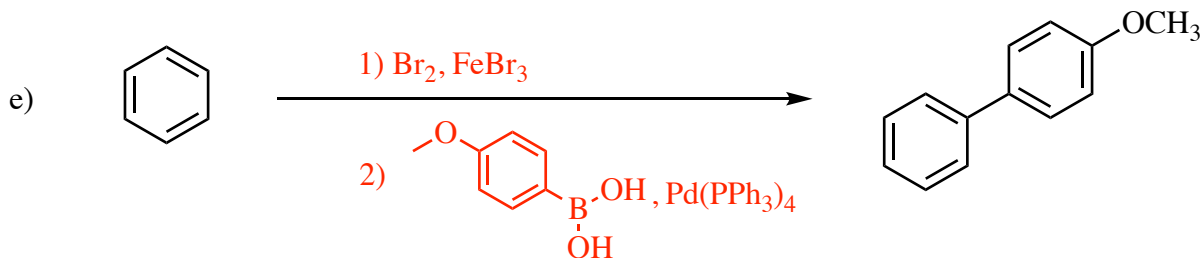
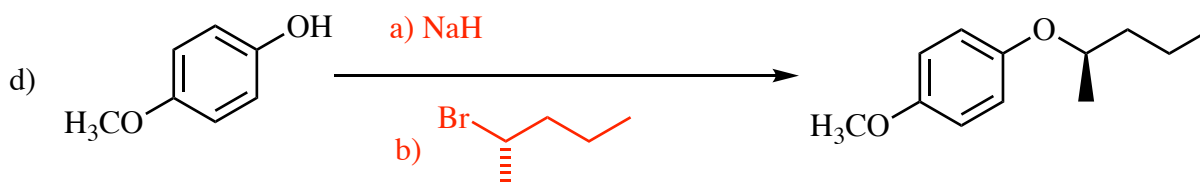
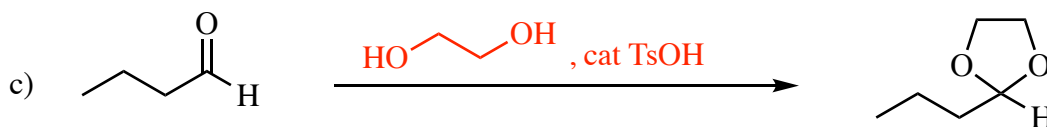
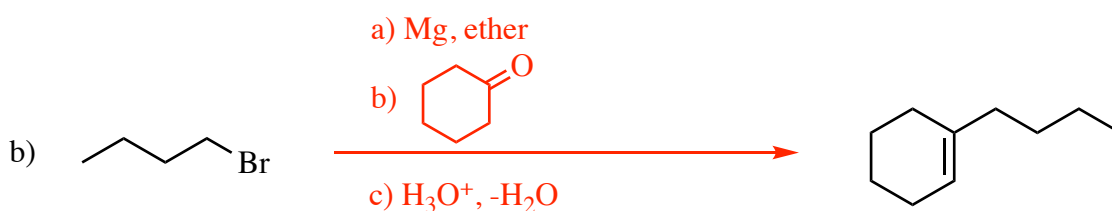
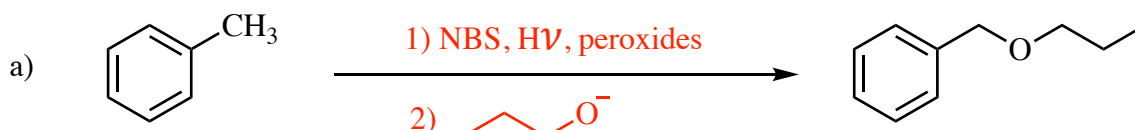
c) For each of the following pairs of carbonyl compounds, circle the one with the MOST HYDRATE at equilibrium.



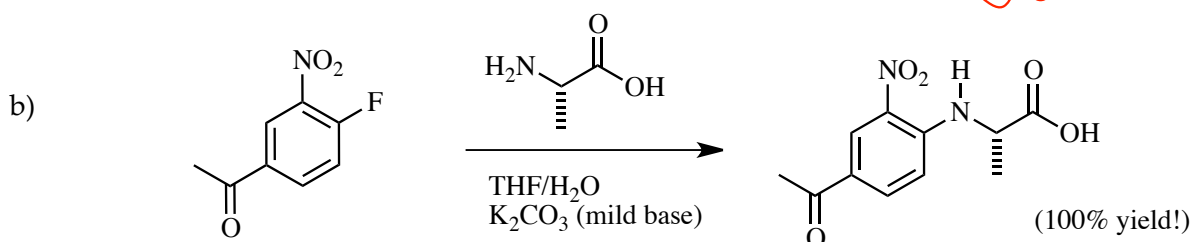
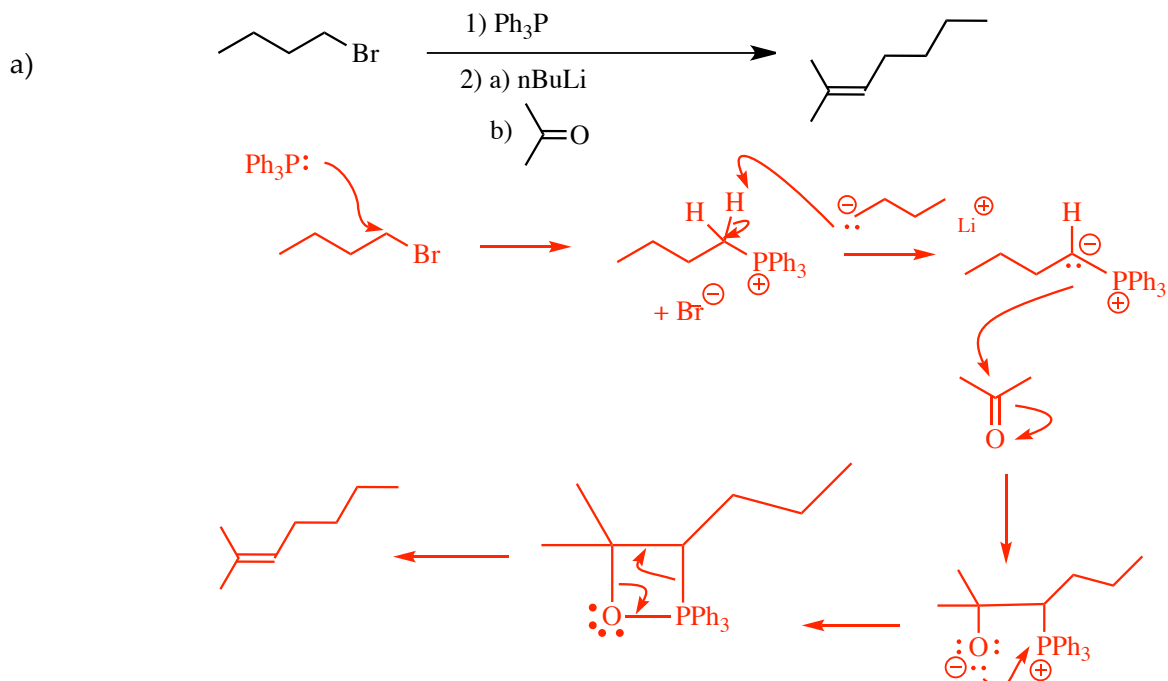
2) (20 pts) Give the **single major product** for each of the following reactions, carefully showing stereochemistry using wedges and dashes if appropriate. If a racemate is formed, show only one enantiomer and label it "rac." Assume chiral starting materials are single pure enantiomers unless they are labeled "rac."



3) (20 pts) Propose reagents for accomplishing each of the following transformations. For reactions involving sequential addition of reagents, label the two parts of the reaction using letters. Your synthesis may require multiple reactions, with isolation of intermediate products, to make the target. Use numbers to indicate individual steps in a multi-step synthesis. Make your synthesis efficient (i.e. the target product should be the major product). Assume chiral starting materials and products are single pure enantiomers unless they are labeled "rac." Assume you can buy any boronic acid intermediates you might need (a good assumption).



4) (20 pts) Propose an arrow-pushing mechanism for each of the following reactions.

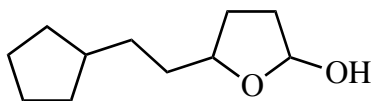


c) Give a short explanation for why the starting material in b) undergoes this reaction. (Your answer should fit in the space below)

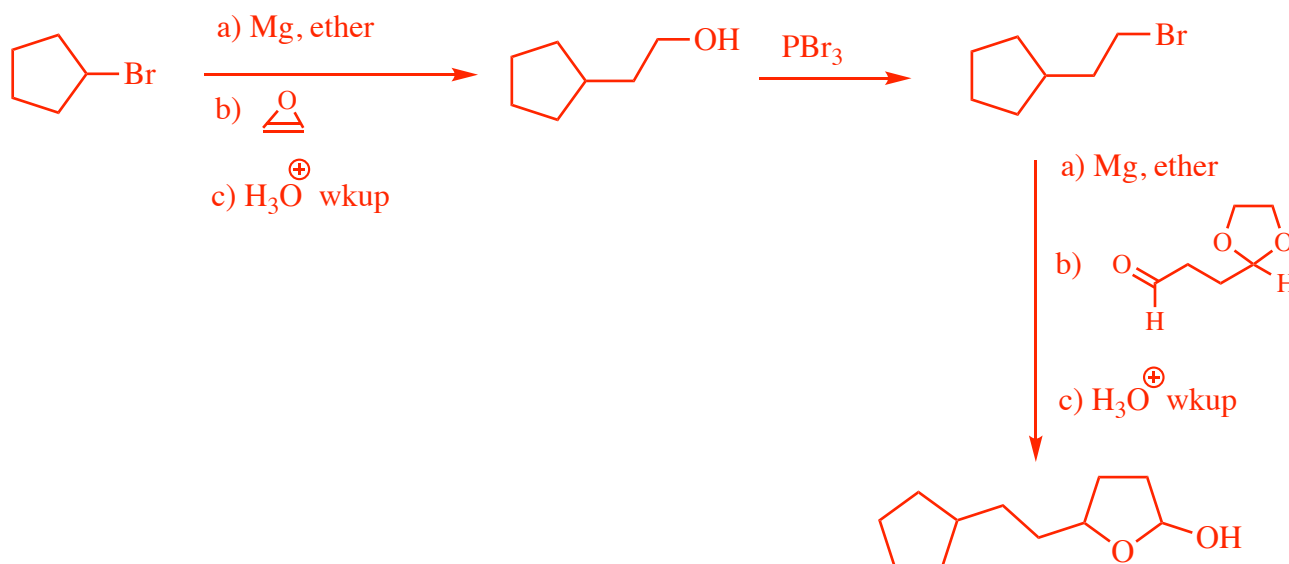
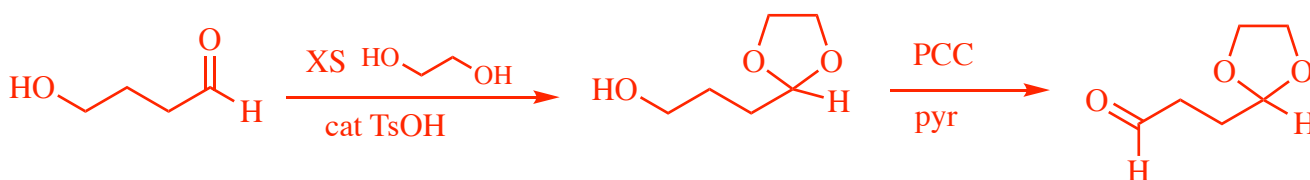
Electronegative groups, including the F atom, activate the ring for nucleophilic aromatic substitution.



5) (20 pts) a) Propose a synthesis of the following targets using any organic starting materials with **five carbons or less**. You may use any necessary inorganic reagents. Try to make your synthesis efficient (i.e. the target should be produced in high yield). More than one step will be required. Each reaction in the sequence leading to an isolated and purified product should be shown. Please use letters to indicate sequential addition of reagents in a single reaction. **Do not put multiple reactions over/under one arrow!**



There are several possible ways to do this synthesis - here's one of them:



b) In this synthesis, you don't need to worry about stereochemistry (which is not shown in the target). Why is stereochemistry a non-issue in this synthesis? (Your answer should fit in the space below).

We show stereochemistry (relative stereochemistry) when there are isolable stereoisomers. In the case of the "stereocenter" at the hemiacetal carbon, one cannot isolate stereoisomers (except perhaps at low temperature or other special conditions) because the hemiacetal is in equilibrium with the open-chain hydroxy aldehyde, and the system exists as an equilibrium mixture of interconverting stereoisomers.