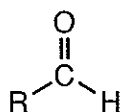


California State Polytechnic University, Pomona
Elements of Organic Chemistry, CHM 201, Dr. Laurie S. Starkey
Chapter 12 (Brown & Poon): Aldehydes & Ketones

12-1

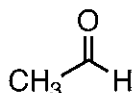
Nomenclature
Aldehydes (RCHO)



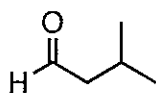
parent: alkanal (C=O is always C#1)



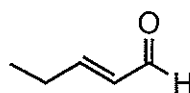
methanal
(formaldehyde)



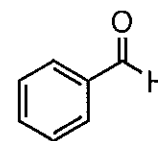
ethanal
(acetaldehyde)



3-methylbutanal
(isobutyraldehyde)

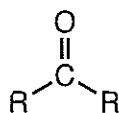


(E)-2-pentenal

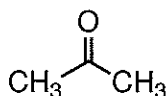


benzaldehyde (common)
IUPAC:

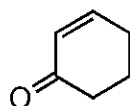
Ketones (RCOR)



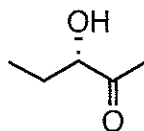
parent: #-alkanone
 (C=O gets lowest possible #)



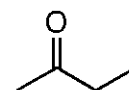
2-propanone
(acetone)



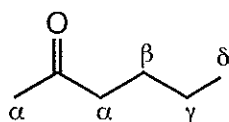
2-cyclohexen-1-one



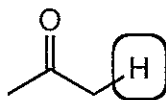
(S)-3-hydroxy-2-pentanone
(ketone is higher priority FG)



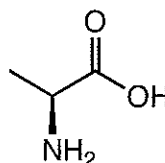
methyl ethyl ketone
(MEK, common)
IUPAC:



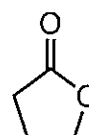
α , β , γ indicates relative position
 (α means "next to" carbonyl)



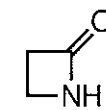
an α proton



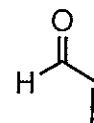
an α -amino
acid



γ -lactone



β -lactam



an α,β -
unsaturated
aldehyde

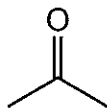
Chapter 12 Outline

- I) Intro (12-1, 12-3) and Nomenclature (12-2)
- II) Reactions of Aldehydes and Ketones with Nucleophiles (Nu:) (12.4)
 - A) Hydride Nu: (12.10)
 - B) Carbon Nu:, the Grignard reagent (12.5)
- III) Reactions of Aldehydes and Ketones with Oxygen Nu: (12.6)
 - A) Water (H₂O) Nu: to form hydrates
 - B) Alcohol (ROH) Nu: to form acetals/ketals
 - C) Acetals in Carbohydrates (17.3)

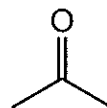
SKIP the following Chapter 12 sections: Reaction with Amines (12.7) and Oxidation reactions (12.9)

Suggested Textbook Problems: 1-7, 10, 12, Quick Quiz (skip 15, 20), end of chapter 13-27 (odd), 35, 39a-g, 43ac, 45bcd, 53.

The carbonyl

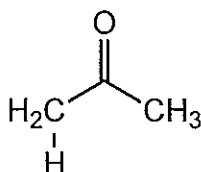


resonance



inductive effects

Reactivity

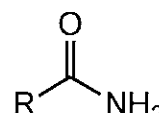
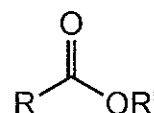
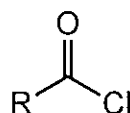
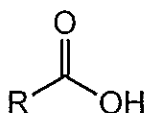
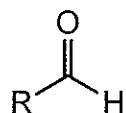
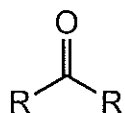


** C=O is very strong and stable functional group

BDE (kcal/mol) C-O 79 C=O 173

** formation of C=O can be a driving force for a reaction

Carbonyl-containing functional groups:



II Reactions of Ketones and Aldehydes with Nucleophiles (Nu:) (12.4)

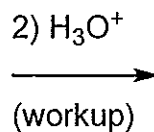
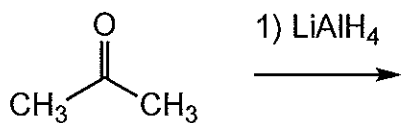
A) Hydride Nu: (12.10)

LiAlH_4 - lithium aluminum hydride (LAH)

NaBH_4 - sodium borohydride

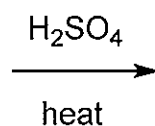
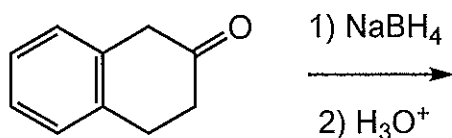
}

both are sources of hydride



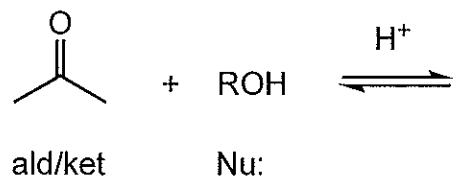
this is described as a reduction reaction

Predict the major product:

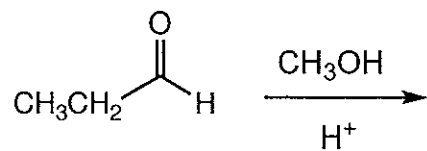


B) Addition of alcohol (ROH) $\rightarrow$ acetal

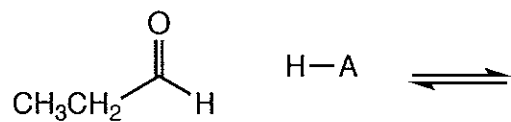
12-4

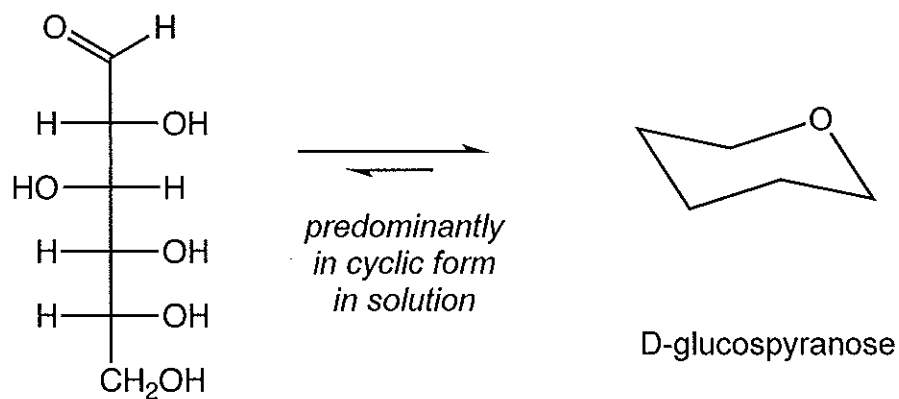


Predict the major product



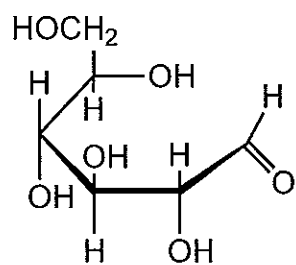
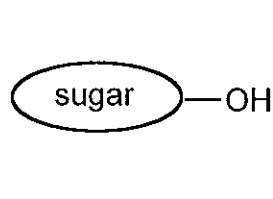
Mechanism: 1st step? in acid, so protonate!



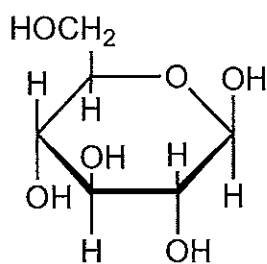


D-glucose

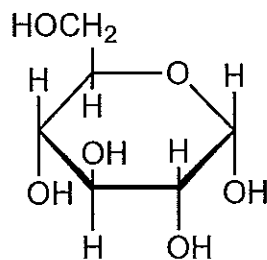
link two sugars to make a disaccharide, and continue links to make polysaccharides



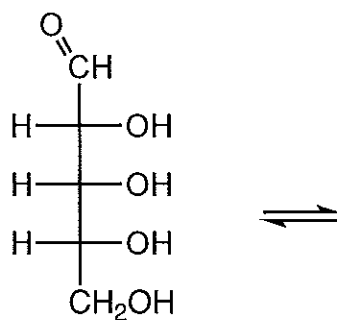
D-glucose


 β -D-glucopyranose
(Haworth projection)

+

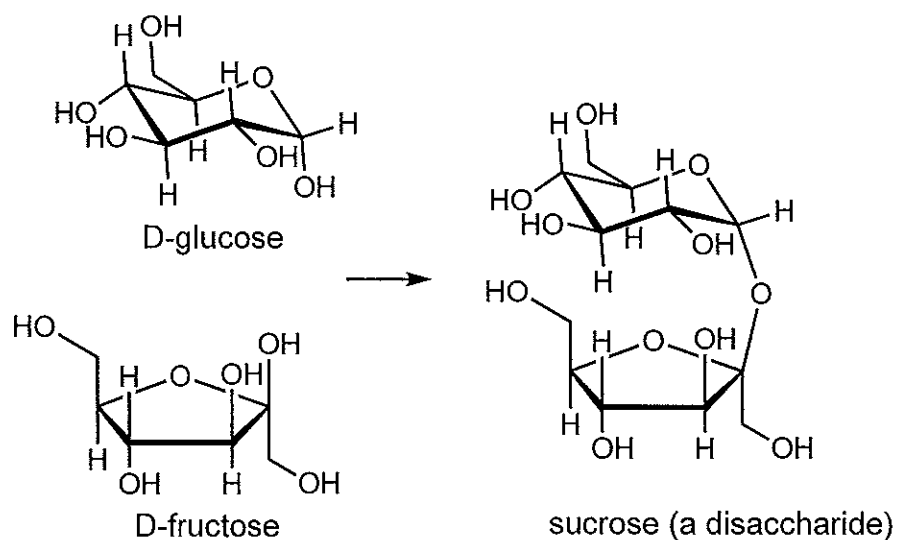
 α -D-glucopyranose

Formation of a 5-membered ring (furanose form)

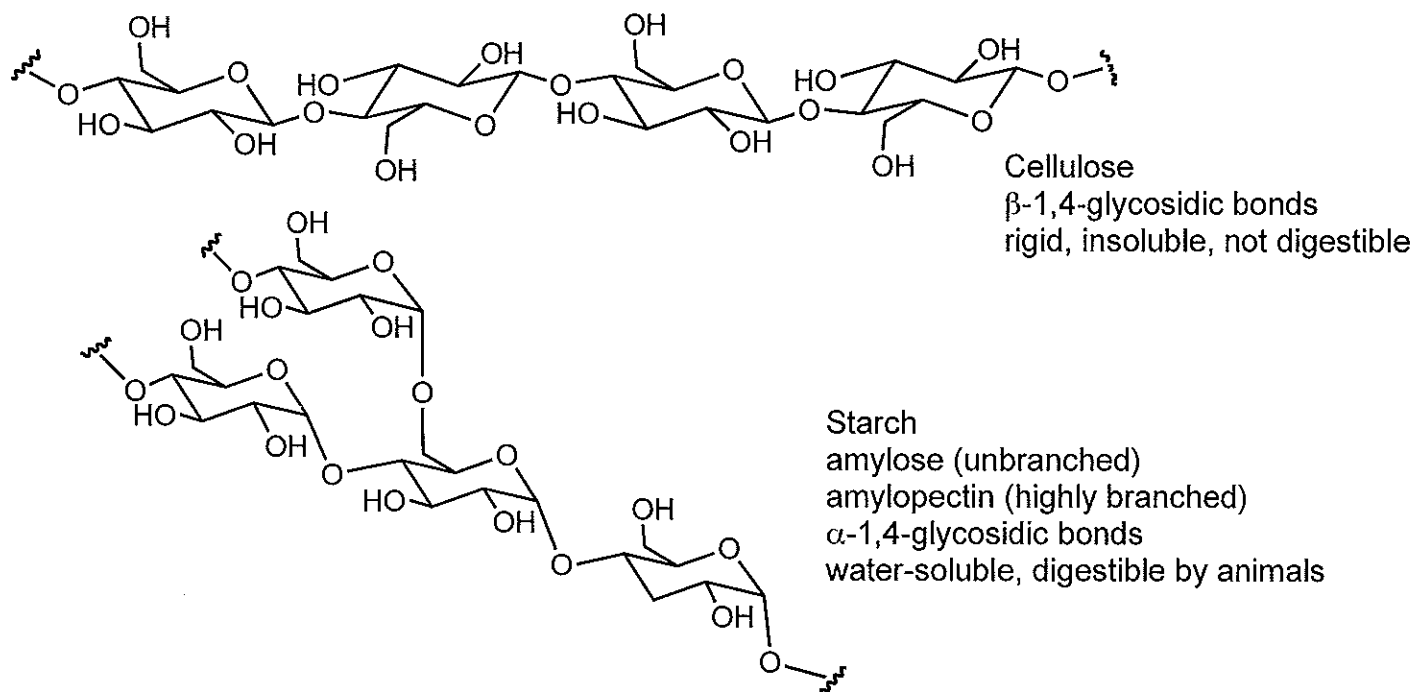


D-ribose

cyclic form (5 memb. ring)



Some Polysaccharides (B&P 17.6)

Other Sugar-Containing Biomolecules
(B&P Chapter 20 - online)