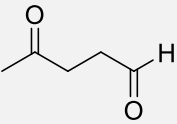
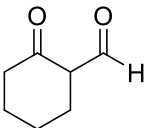
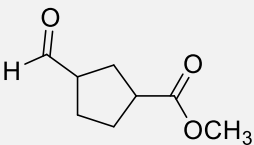
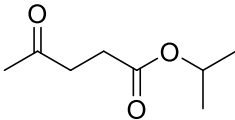
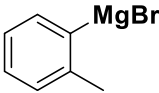
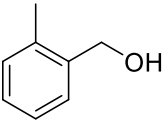
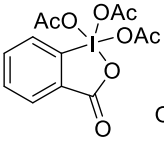

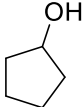


### Chapter 19 Worksheet – Aldehydes & Ketones

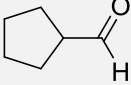
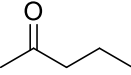
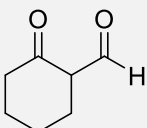
#### 19A. ALDEHYDES & KETONES – the Chapter 12 overlap with chemoselective flair!

- Draw the product of each reaction: **starting material + reagent → Product.**

	<b>Starting Material</b>	<b>Reagents &amp; translation</b> *know this mechanism	<b>Alternate reagents</b> (same product)	<b>Draw the Product</b> Pay attention to the amount of reagent added!
1		<p><b>*(a) xs NaBH<sub>4</sub>, MeOH</b></p> <p><i>sodium borohydride in methanol</i></p>	<ul style="list-style-type: none"> <li>• H<sub>2</sub> with Pt, Pd, or Ni</li> <li><i>hydrogen gas with platinum, palladium, or nickel</i></li> <li>• 1. xs LiAlH<sub>4</sub> 2. H<sub>2</sub>O</li> </ul>	
2		<p><b>* (b) 1. LiAlH<sub>4</sub> (1 mol)</b> <b>2. H<sub>2</sub>O</b></p> <p><i>lithium aluminum hydride followed by water</i></p>	<ul style="list-style-type: none"> <li>• NaBH<sub>4</sub>, MeOH</li> <li>• H<sub>2</sub> with Pt, Pd, or Ni</li> </ul>	
3		<p><b>* (c) 1. xs CH<sub>3</sub>CH<sub>2</sub>MgBr</b> <b>2. H<sub>2</sub>O</b></p> <p><i>Ethyl magnesium bromide followed by water</i></p>	<ol style="list-style-type: none"> <li>1. EtMgBr - abbreviation</li> <li>2. H<sub>2</sub>O</li> </ol>	
4		<p><b>* (d) (1 mol)</b></p> <ol style="list-style-type: none"> <li>1.  MgBr</li> <li>2. H<sub>2</sub>O</li> </ol> <p><i>Ortho-tolyl magnesium bromide followed by water</i></p>	<ol style="list-style-type: none"> <li>1. o-tol-MgBr - abbreviation</li> <li>2. H<sub>2</sub>O</li> </ol>	
5		<p><b>(e) DMP, CH<sub>2</sub>Cl<sub>2</sub></b></p>  <p>OAc = </p> <p><b>Dess-Martin Periodinane (DMP)</b></p> <p><i>in methylene chloride solvent</i></p>	<ul style="list-style-type: none"> <li>• PCC, CH<sub>2</sub>Cl<sub>2</sub></li> <li><i>Pyridinium chlorochromate in methylene chloride solvent</i></li> <li>• 1. DMSO, (COCl)<sub>2</sub></li> <li>2. Et<sub>3</sub>N</li> <li><i>Dimethylsulfoxide &amp; oxalyl chloride, then triethylamine</i></li> </ul>	
6		<p><b>(f) Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, H<sub>2</sub>SO<sub>4</sub>, H<sub>2</sub>O</b></p> <p><i>Sodium dichromate in aqueous sulfuric acid</i></p>	<ul style="list-style-type: none"> <li>• Chromic Acid (H<sub>2</sub>CrO<sub>4</sub>)</li> <li>• CrO<sub>3</sub>, H<sub>3</sub>O<sup>+</sup></li> </ul>	

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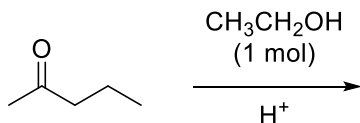
### 19B. More NUCLEOPHILIC ADDITION REACTIONS

Starting Material		Reagents & translation *know this mechanism	Draw the Product Pay attention to the amount of reagent added!
7		<b>*(g) CH<sub>3</sub>CH<sub>2</sub>OH (1 mol), H<sup>+</sup></b> <i>1 molar equivalent of ethanol under acidic conditions</i>	
8		<b>*(h) HCN (1 mol)</b> <i>1 molar equivalent of hydrogen cyanide</i>	
2		<b>*(i) xs HCN</b> <i>Excess hydrogen cyanide</i>	

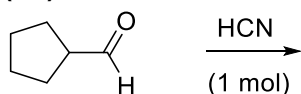
### 19B. ACIDIC NUCLEOPHILIC ADDITION MECHANISMS

- Draw the arrow-pushing mechanism for each reaction, including all charged intermediates and product.

(8g)



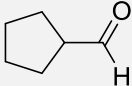
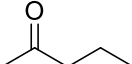
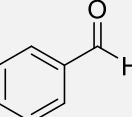
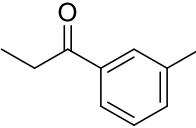
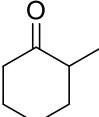
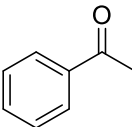

(7h)



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### 19C. NUCLEOPHILIC ADDITION & DEHYDRATION OF ALDEHYDES & KETONES

- Draw the product of each reaction: **starting material + reagent → Product.**

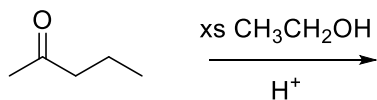
	Starting Material	Reagents & translation *know this mechanism	Draw the Product Pay attention to amount of reagent!
7		<p><b>*(j) xs CH<sub>3</sub>CH<sub>2</sub>OH, H<sup>+</sup></b>   <i>excess ethanol under acidic conditions</i></p>	
8		<p><b>*(k) HOCH<sub>2</sub>CH<sub>2</sub>OH, H<sup>+</sup></b>   <i>1,2-ethanediol under acidic conditions</i></p>	
9		<p><b>*(l) H<sub>2</sub>NCH<sub>3</sub>, H<sup>+</sup></b>   <i>Methylamine with acid catalyst</i></p>	
10		<p><b>*(m) HN(CH<sub>3</sub>CH<sub>2</sub>)<sub>2</sub>, H<sup>+</sup></b>   <i>Diethylamine with acid catalyst</i></p>	
11		<p><b>(n) H<sub>2</sub>NNH<sub>2</sub>, KOH</b>   <i>Hydrazine and potassium hydroxide (basic conditions)</i></p>	
12		<p><b>(o) Ph<sub>3</sub>P=CH<sub>2</sub></b>   <i>Wittig reagent – methylene triphenylphosphine</i></p>	
13		<p><b>(o) Ph<sub>3</sub>P=CHCH<sub>2</sub>Ph</b>   <i>Wittig reagent – 2-phenyl ethylene triphenylphosphine</i></p>	

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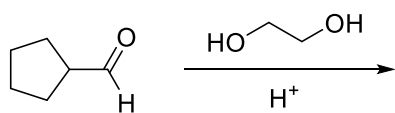
### 19C. NUCLEOPHILIC ADDITION & DEHYDRATION MECHANISMS

- Draw the arrow-pushing mechanism for each reaction, including all charged intermediates and product.

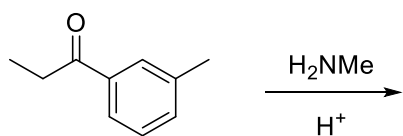
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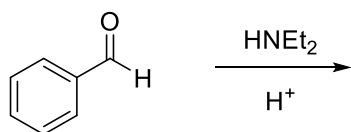
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(10l)

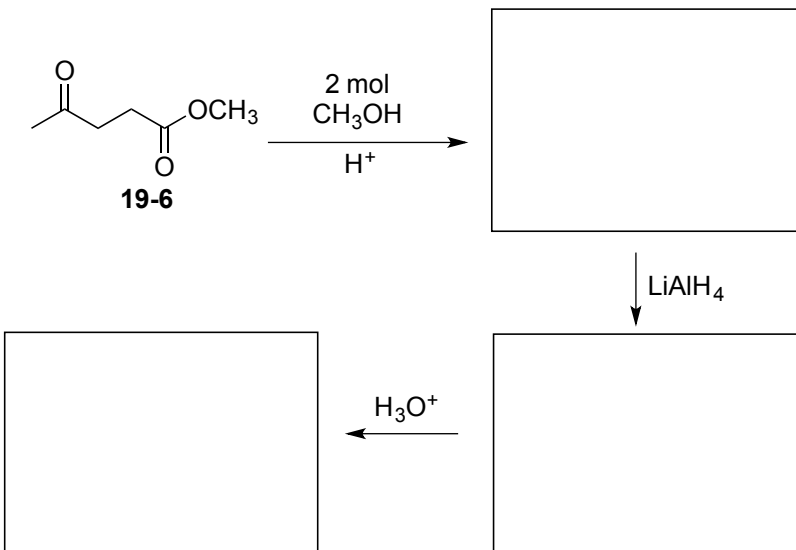
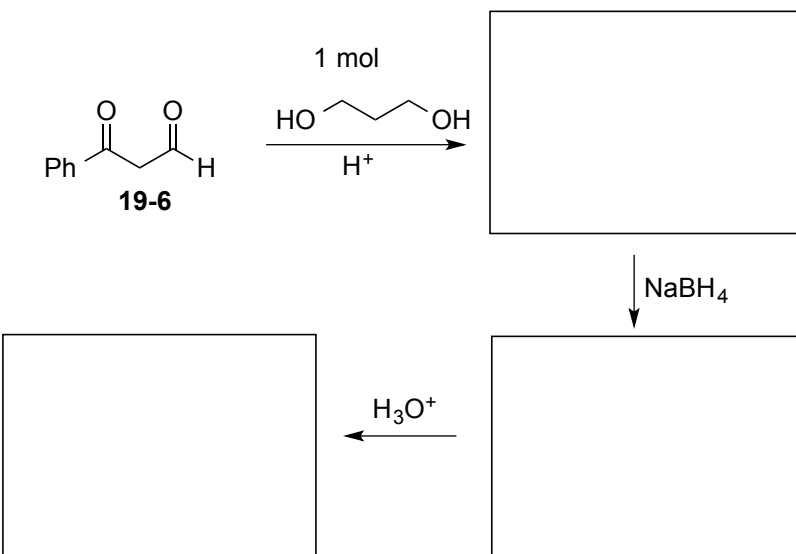
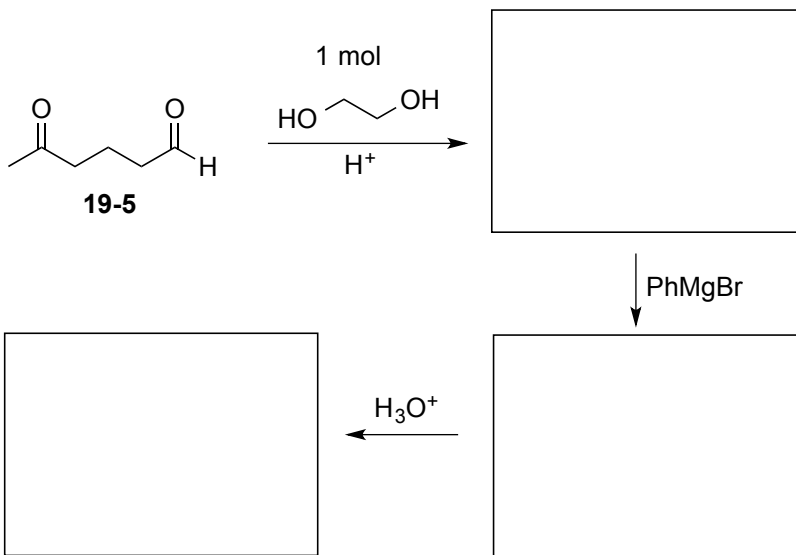


(9m)



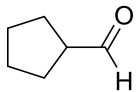
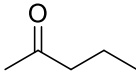
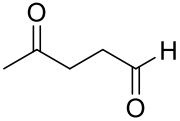
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**19D. Chemoselectivity with Acetal Protecting Groups** – Fill in each box with the product to complete all three puzzles.



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**BONUS: Mix & Match with Reaction Bootcamp!**

React each aldehyde or ketone with <b>1 mole of each reagent</b> and draw the product in the box	7. 	8. 	1. 
*(g) $\text{CH}_3\text{CH}_2\text{OH}, \text{H}^+$			
*(h) $\text{HCN}$			
* (k) $\text{HOCH}_2\text{CH}_2\text{OH}, \text{H}^+$			
* (l) $\text{H}_2\text{NCH}_3, \text{H}^+$			
* (m) $\text{HN}(\text{CH}_3\text{CH}_2)_2, \text{H}^+$			
(n) $\text{H}_2\text{NNH}_2, \text{KOH}$			
(o) $\text{Ph}_3\text{P}=\text{CHCH}_2\text{Ph}$			