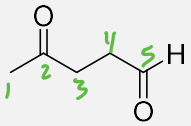
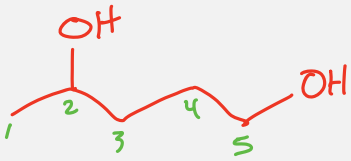
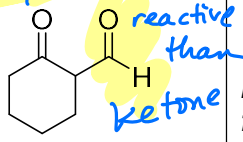
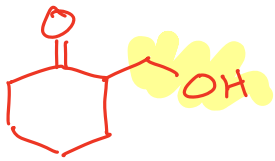
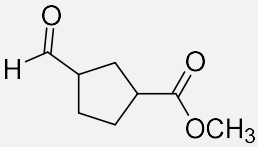
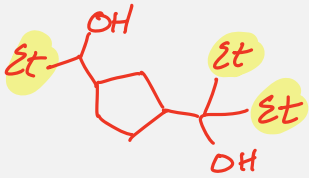
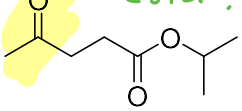
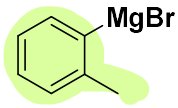
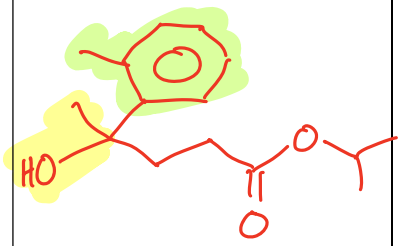
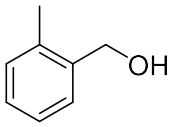
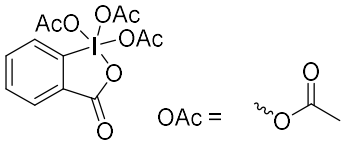
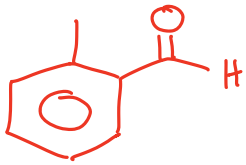
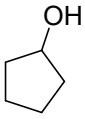
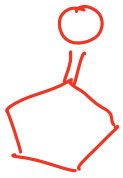
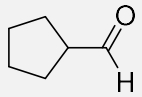
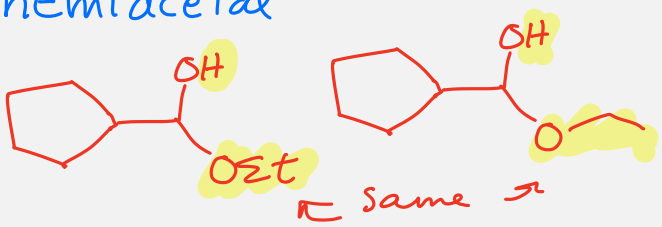
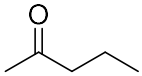
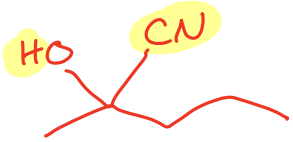
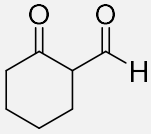
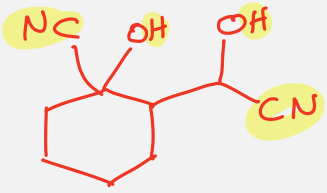
Chapter 19 Worksheet – Aldehydes & Ketones

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

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

	Starting Material	**Reagents** *& translation* *know this mechanism	**Alternate reagents** (same product)	**Draw the Product** Pay attention to the amount of reagent added!
1		***(a) xs $NaBH_4$, MeOH** *sodium boro**hydride** in methanol*	• H_2 with Pt, Pd, or Ni *hydrogen gas with platinum, palladium, or nickel* • 1. xs $LiAlH_4$ 2. H_2O	
2	aldehyde more reactive than ketone 	*** (b) 1. $LiAlH_4$ (1 mol)** **2. H_2O** *lithium aluminum **hydride** followed by water*	• $NaBH_4$, MeOH • H_2 with Pt, Pd, or Ni	
3		*** (c) 1. xs CH_3CH_2MgBr** **2. H_2O** ***Ethyl** magnesium bromide followed by water*	1. EtMgBr - abbreviation 2. H_2O	
4	ketone more reactive than ester! 	*** (d) (1 mol)** **1.**  **2. H_2O** ***Ortho-tolyl** magnesium bromide followed by water*	1. *o*-tol-MgBr - abbreviation 2. H_2O	
5		**(e) DMP, CH_2Cl_2**  **Dess-Martin Periodinane** (DMP) *in methylene chloride solvent*	• PCC, CH_2Cl_2 *Pyridinium chlorochromate in methylene chloride solvent* • 1. DMSO, $(COCl)_2$ 2. Et_3N *Dimethylsulfoxide & oxalyl chloride, then triethylamine*	
6		**(f) $Na_2Cr_2O_7$, H_2SO_4, H_2O** *Sodium dichromate in aqueous sulfuric acid*	• Chromic Acid (H_2CrO_4) • CrO_3, H_3O^+	

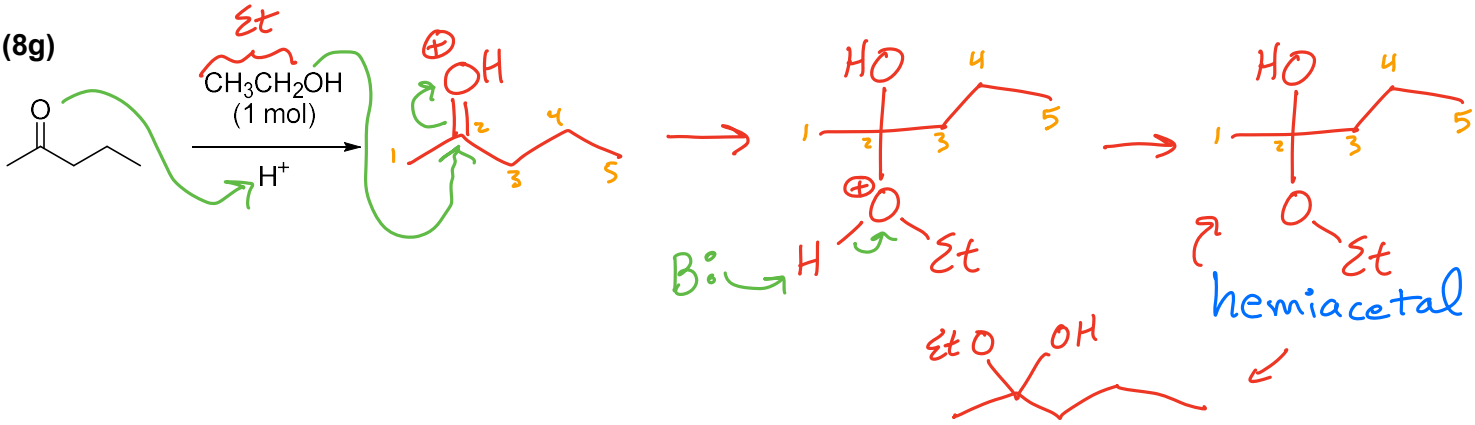
19B. More NUCLEOPHILIC ADDITION REACTIONS

	Starting Material	**Reagents** & *translation* *know this mechanism	**Draw the Product** Pay attention to the amount of reagent added!
7		EtOH ***(g) CH_3CH_2OH (1 mol), H^+** *1 molar equivalent of* ***ethanol*** *under* ***acidic*** *conditions*	hemiacetal  same
8		*** (h) HCN (1 mol)** *1 molar equivalent of* ***hydrogen cyanide***	 new C-C bonds formed wooo!
2		*** (i) xs HCN** *Excess* ***hydrogen cyanide***	

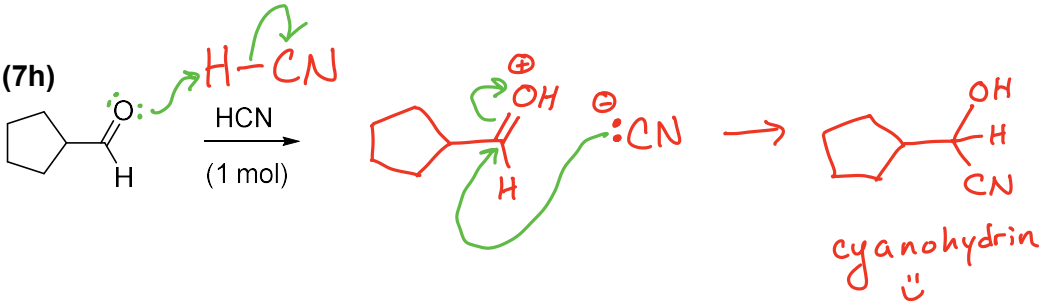
19B. ACIDIC NUCLEOPHILIC ADDITION MECHANISMS

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

(8g)

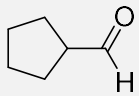
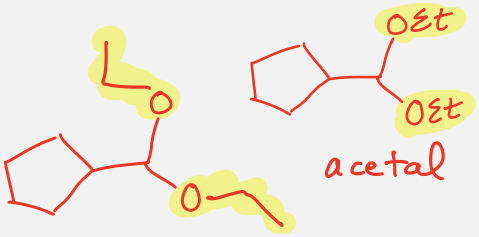
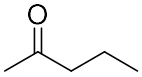
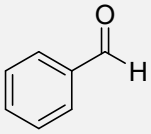
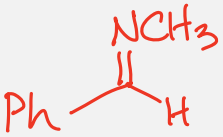
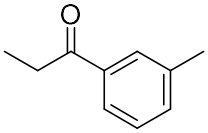
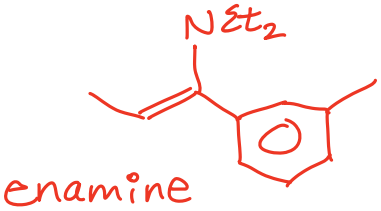
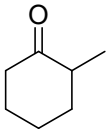
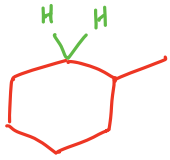
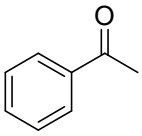
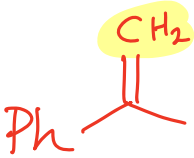
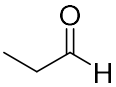
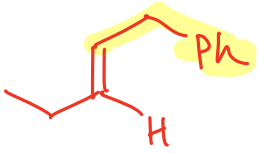


(7h)



19C. NUCLEOPHILIC ADDITION & DEHYDRATION OF ALDEHYDES & KETONES

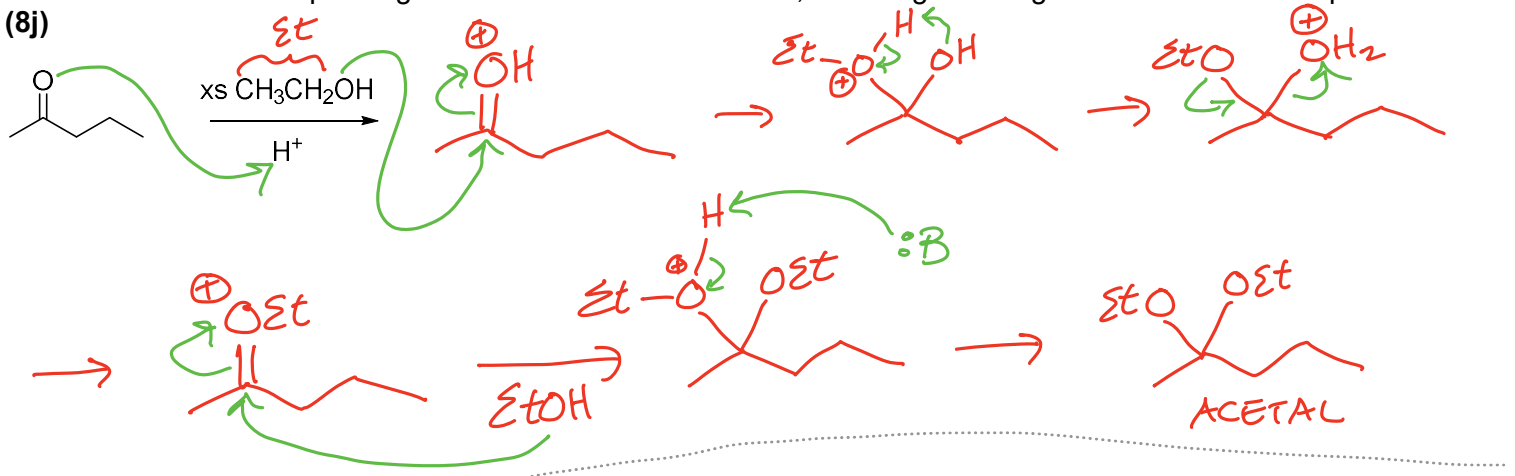
- Draw the product of each reaction: **starting material + reagent → Product.**

	Starting Material	Reagents *& translation* *know this mechanism	Draw the Product Pay attention to amount of reagent!	
7		***(j) xs CH_3CH_2OH, H^+** *excess **ethanol** under **acidic** conditions*	 acetal	+ H_2O
8		*** (k) $HOCH_2CH_2OH$, H^+** ***1,2-ethanediol** under **acidic** conditions*	 cyclic acetal	+ H_2O
9		1° amine *** (l) H_2NCH_3, H^+** ***Methylamine** with **acid** catalyst*	 imine	+ H_2O
10		2° amine *** (m) $HN(CH_3CH_2)_2$, H^+** ***Diethylamine** with **acid** catalyst*	 enamine	+ H_2O
11		**(n) H_2NNH_2, KOH** ***Hydrazine** and **potassium hydroxide** (basic conditions)*		+ H_2O
12		**(o) $Ph_3P{=}CH_2$** *Wittig reagent – **methylene triphenylphosphine***		+ $Ph_3\overset{O}{\overset{\|\|}{P}}$
13		**(o) $Ph_3P{=}CHCH_2Ph$** *Wittig reagent – **2-phenyl ethylene triphenylphosphine***		+ $Ph_3\overset{O}{\overset{\|\|}{P}}$

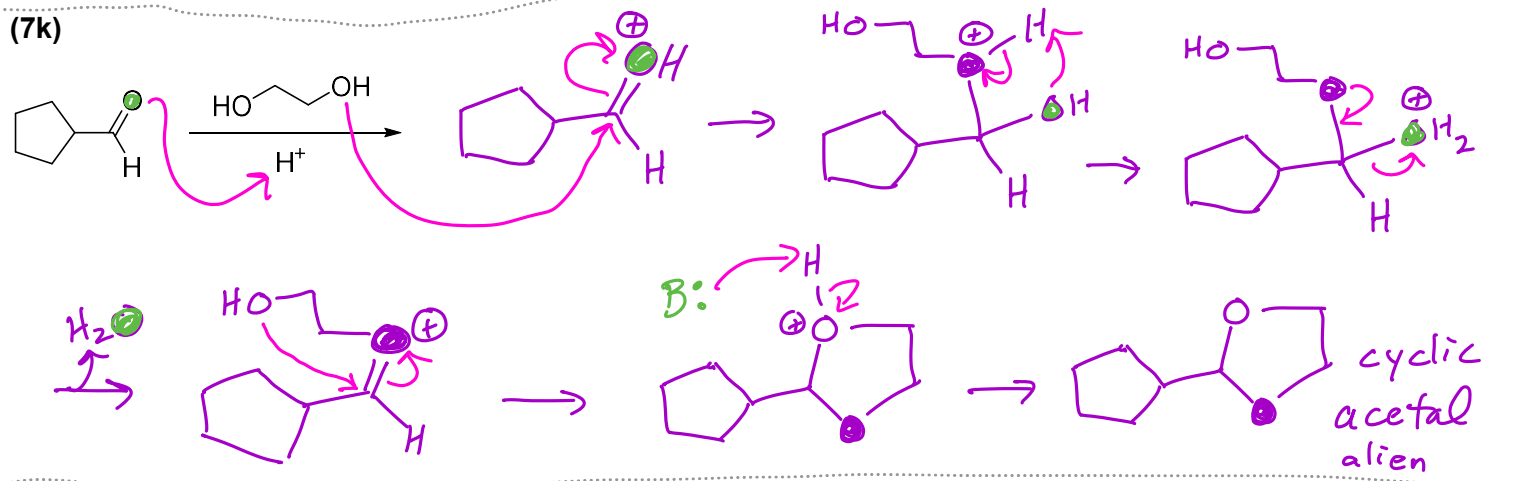
19C. NUCLEOPHILIC ADDITION & DEHYDRATION MECHANISMS

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

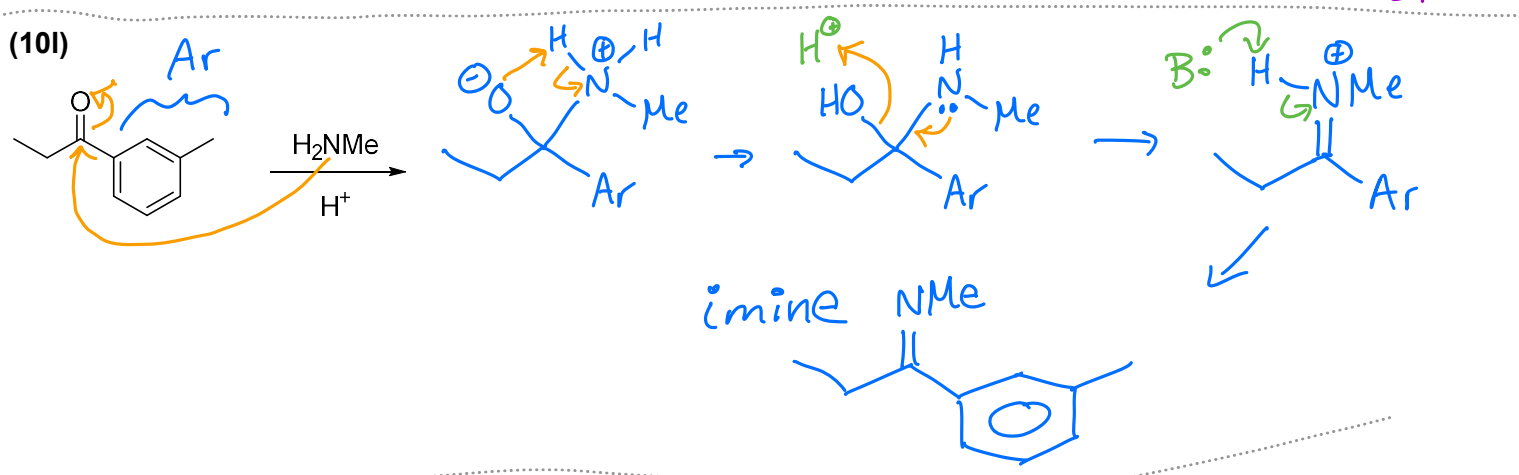
(8j)



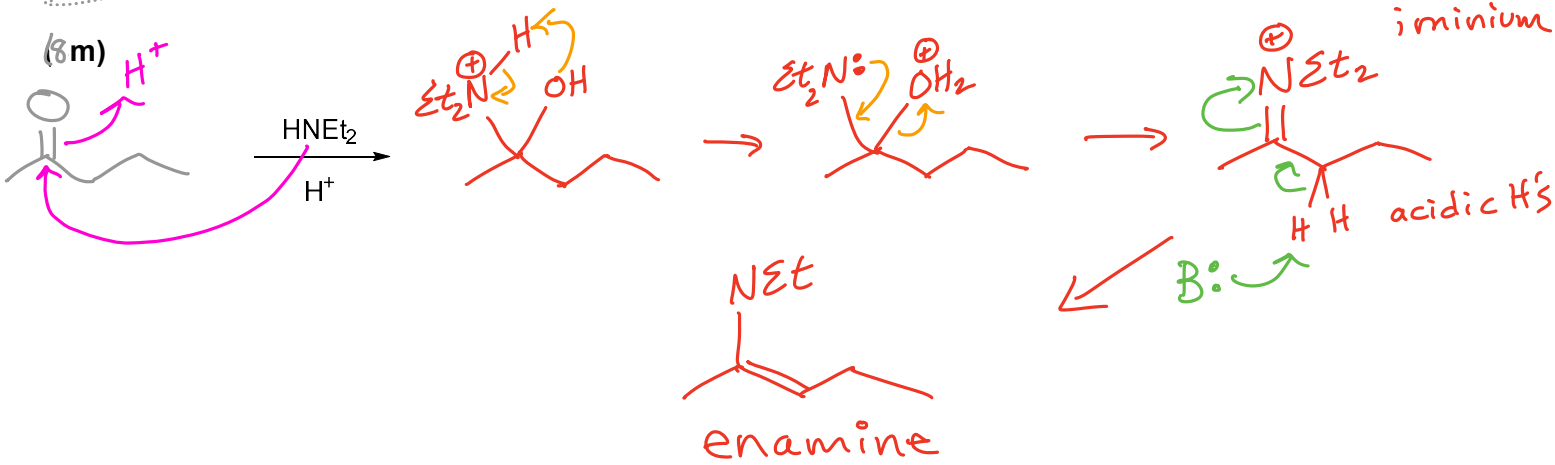
(7k)



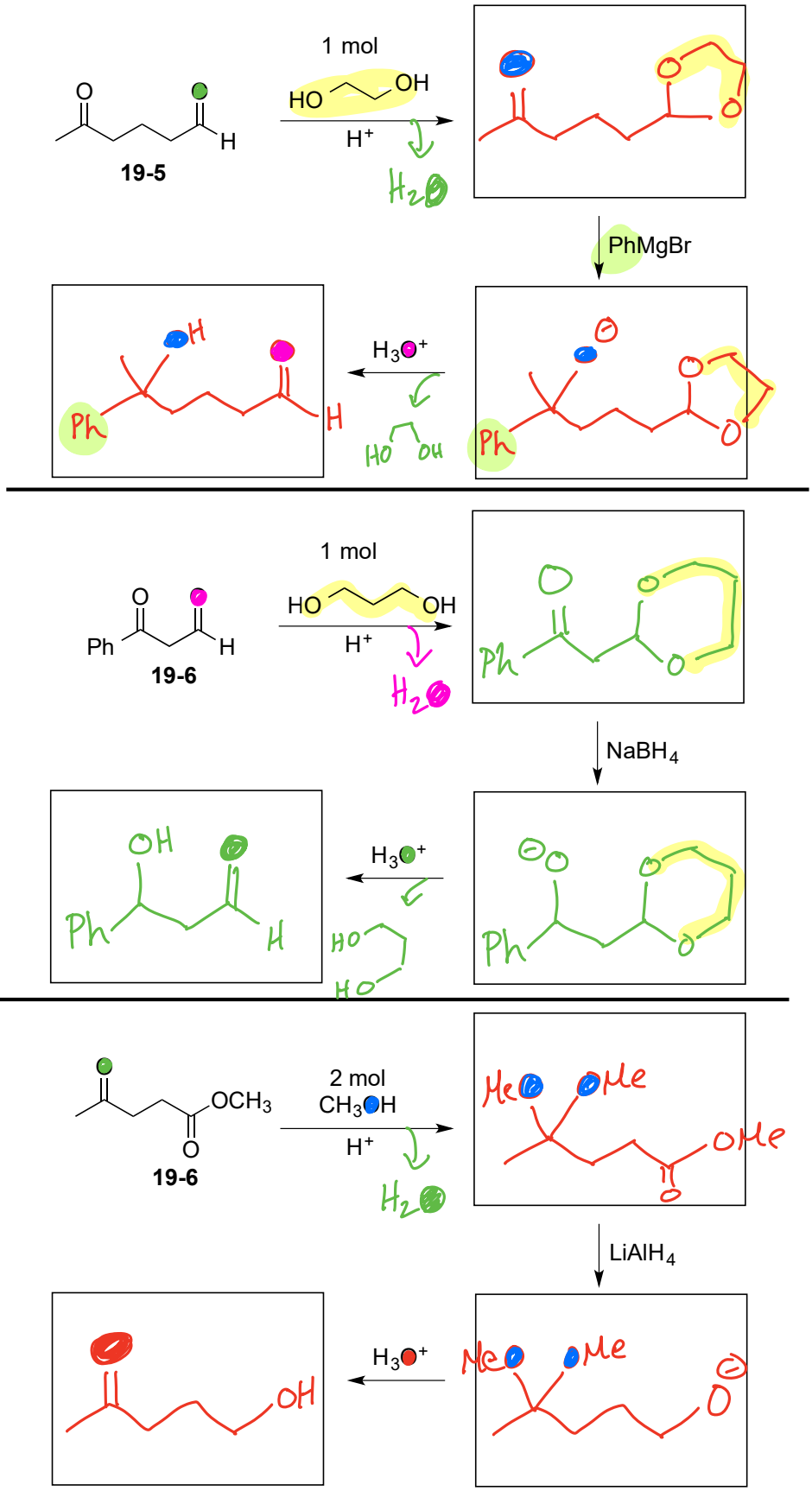
(10l)



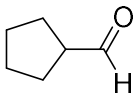
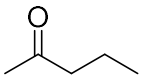
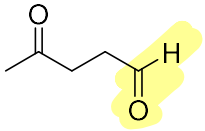
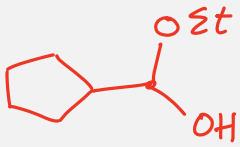
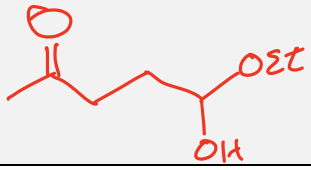
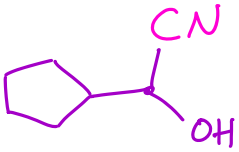
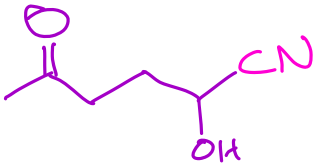
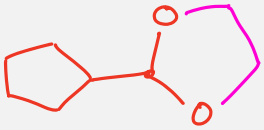
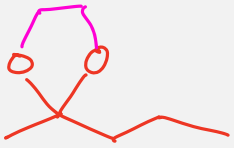
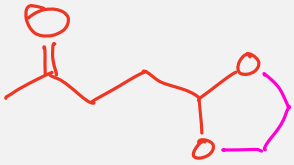
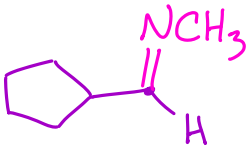
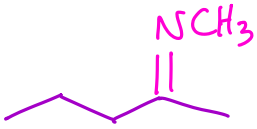
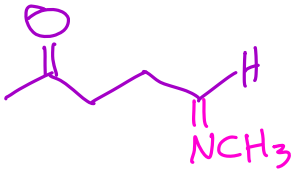
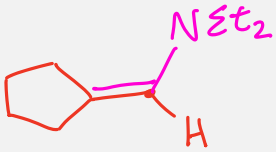
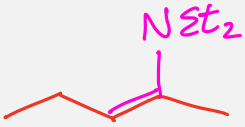
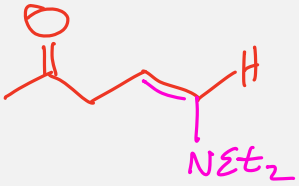
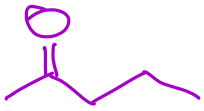
(8m)



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



BONUS: Mix & Match with Reaction Bootcamp!

React each aldehyde or ketone with **1 mole of each reagent** and draw the product in the box	**7.** 	**8.** 	**1.** 
***(g) CH_3CH_2OH, H^+** EtOH hemiacetal			
***(h) HCN** cyanohydrin			
diol *** (k) $HOCH_2CH_2OH$, H^+** cyclic acetal			
1° amine *** (l) H_2NCH_3, H^+** imine			
2° amine *** (m) $HN(CH_3CH_2)_2$, H^+** enamine			
(n) H_2NNH_2, KOH			
(o) $Ph_3P{=}CHCH_2Ph$