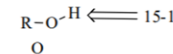
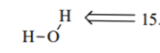
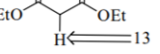
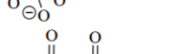
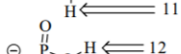
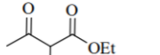
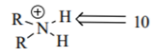
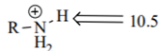
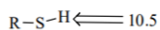
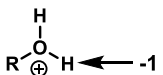
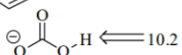
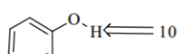
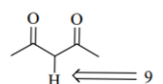
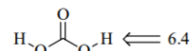
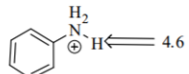
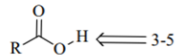
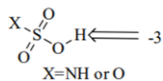
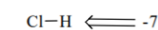


Name: _____

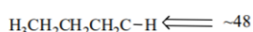
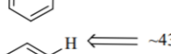
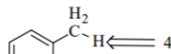
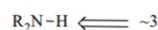
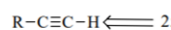
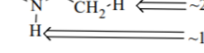
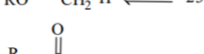
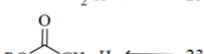
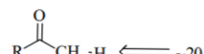
You have 50 minutes to complete Part 1 of the Exam.

IA																0																			
1 H 1.008		IIA														2 He 4.003																			
3 Li 6.941		4 Be 9.012														5 B 10.81		6 C 12.01		7 N 14.01		8 O 16.00		9 F 19.00		10 Ne 20.18									
11 Na 22.99		12 Mg 24.31		IIIB		IVB		VB		VIB		VIIB		VIIIB				IB		IIB		13 Al 26.98		14 Si 28.09		15 P 30.97		16 S 32.06		17 Cl 35.45		18 Ar 39.95			
19 K 39.10		20 Ca 40.08		21 Sc 44.96		22 Ti 47.90		23 V 50.94		24 Cr 52.00		25 Mn 54.94		26 Fe 55.85		27 Co 58.93		28 Ni 58.70		29 Cu 63.55		30 Zn 65.38		31 Ga 69.72		32 Ge 72.59		33 As 74.92		34 Se 78.96		35 Br 79.90		36 Kr 83.80	
37 Rb 85.47		38 Sr 87.62		39 Y 88.91		40 Zr 91.22		41 Nb 92.91		42 Mo 95.94		43 Tc (98)		44 Ru 101.1		45 Rh 102.9		46 Pd 106.4		47 Ag 107.9		48 Cd 112.4		49 In 114.8		50 Sn 118.7		51 Sb 121.8		52 Te 127.6		53 I 126.9		54 Xe 131.3	
55 Cs 132.9		56 Ba 137.3		57 ~ La 138.9		72 Hf 178.5		73 Ta 180.9		74 W 183.9		75 Re 186.2		76 Os 190.2		77 Ir 192.2		78 Pt 195.1		79 Au 197.0		80 Hg 200.6		81 Tl 204.4		82 Pb 207.2		83 Bi 209.0		84 Po (209)		85 At (210)		86 Rn (222)	
87 Fr (223)		88 Ra (226.0)		89 ~ Ac (227)		104 Rf		105 Ha		106 Unh		107 Uns		108		109 Une																			

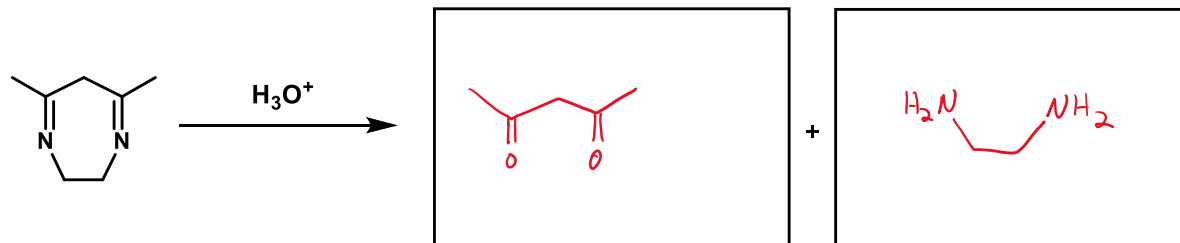
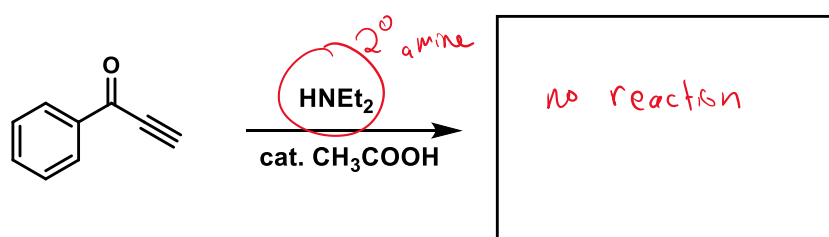
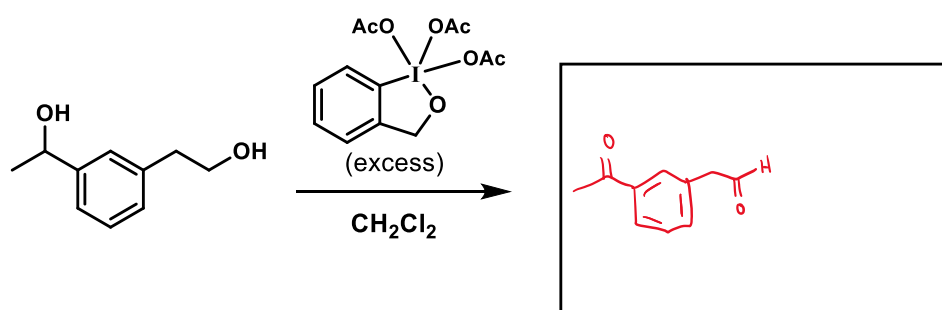
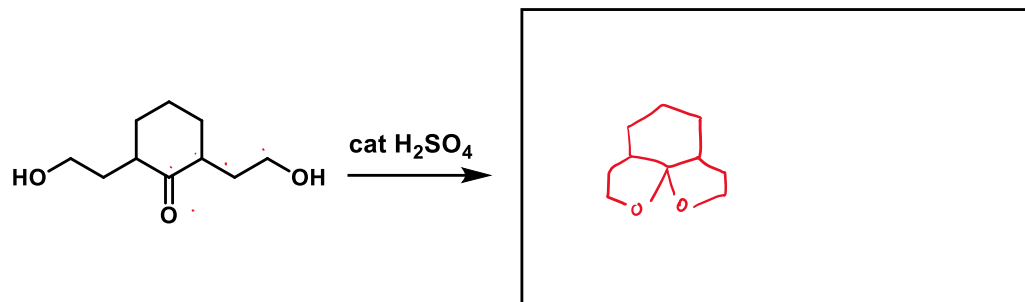
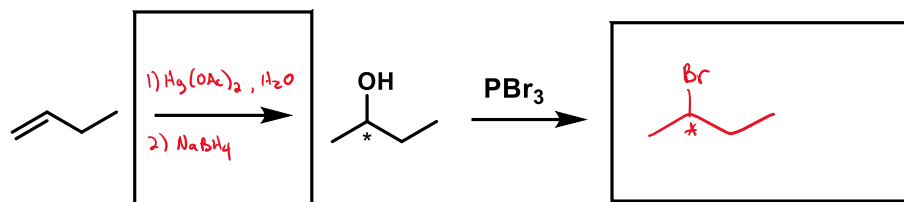
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** 90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

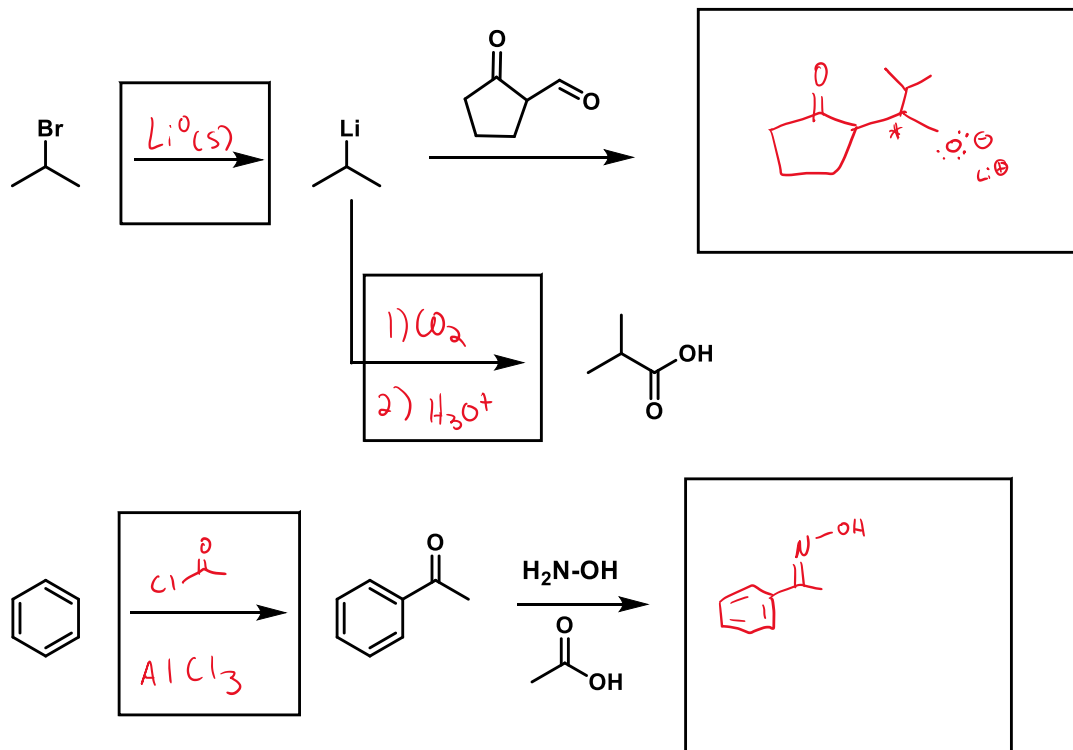
pK_a information

Note: R=alkyl

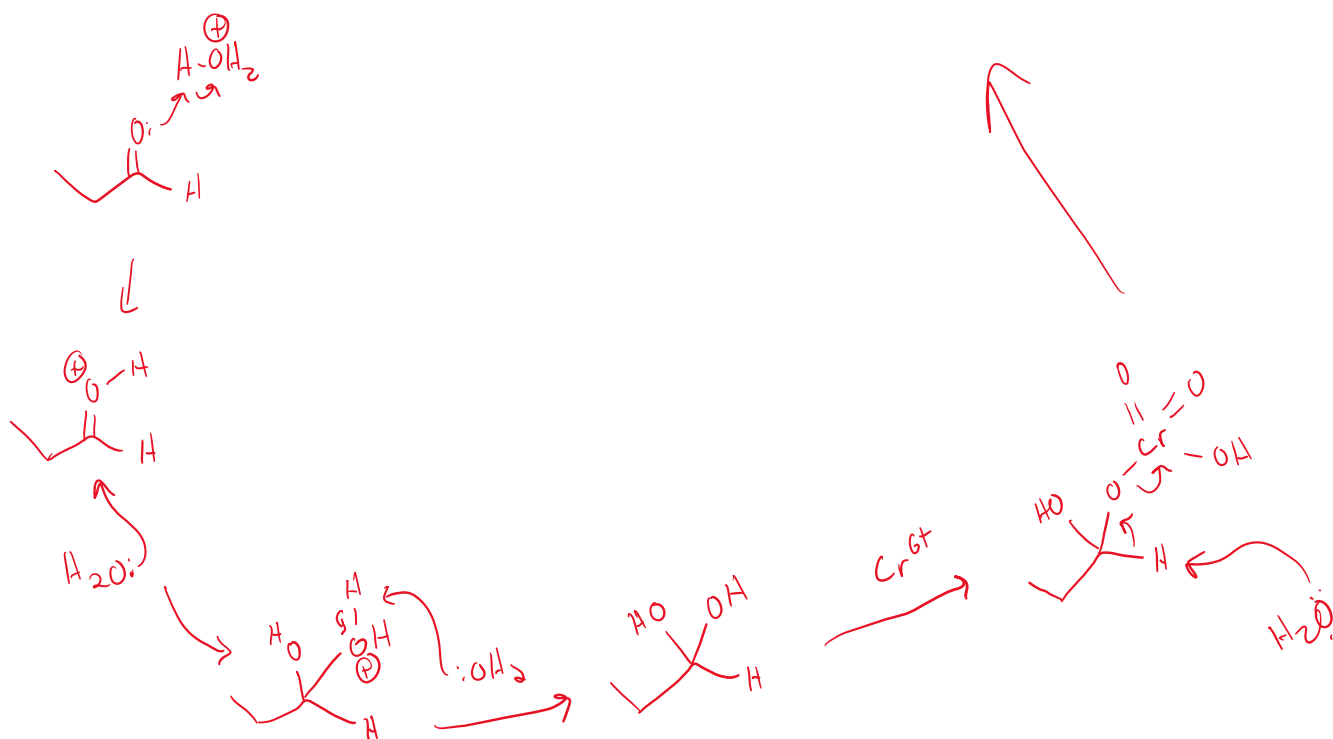
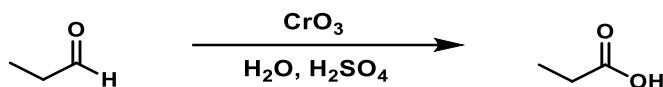


1. (27 pts) Fill in the missing reagents or products, as appropriate. Be sure to indicate stereochemistry where relevant. For reactions missing the product(s), "no reaction" may be the correct answer.

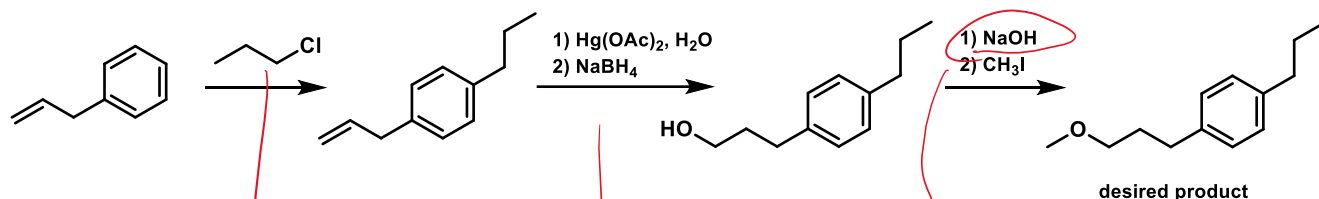




2. (8 pts) Draw the mechanism for the reaction below. Do not show arrow-pushing for generation of any intermediates containing chromium.



3. (12 pts) The synthetic scheme below will not produce the desired product. Identify and explain the flaw(s) in each step. Then, propose a revised synthesis that will achieve the desired product. Assume that the substituent in the starting material has the same effects as an alkyl group.



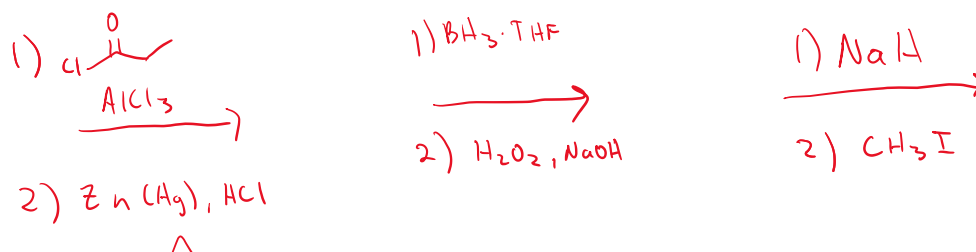
explanation of flaws:

missing catalyst
+
susceptible to C^+
rearrangement

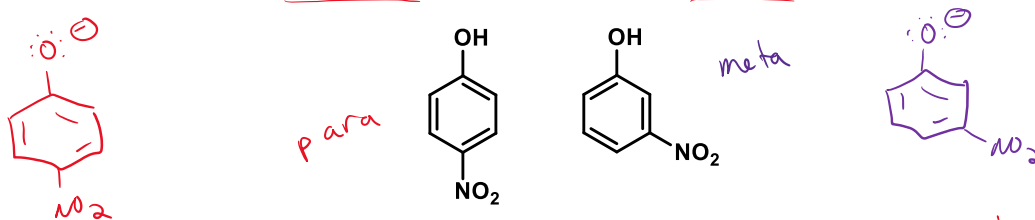
will give
markovnikov
product

will not
fully deprotonate
alcohol

revised synthesis:

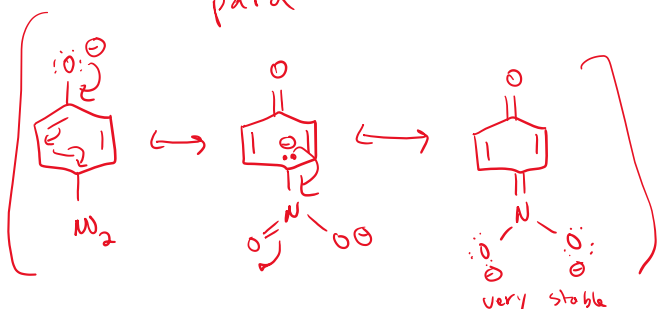


4. (6 pts) The O-H bond in para-nitrophenol is significantly more acidic than that of meta-nitrophenol.

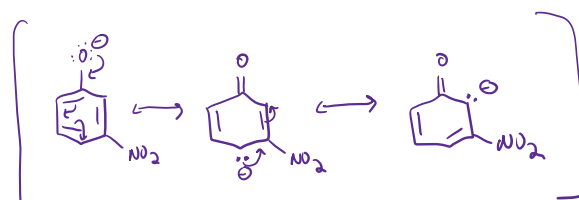


- a.) Is the pK_a of para-nitrophenol higher or lower than the pK_a of meta-nitrophenol? lower (more acidic)
- b.) Explain this observed difference in acidity. You can use the space next to each molecule to **draw the conjugate base of each**, and any other structures that aid your explanation.

para



meta



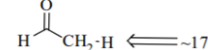
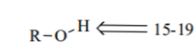
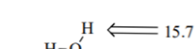
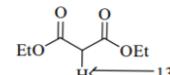
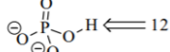
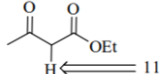
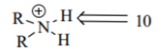
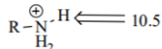
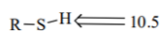
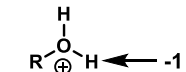
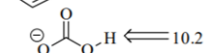
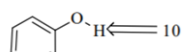
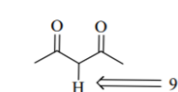
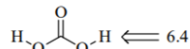
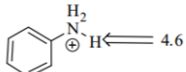
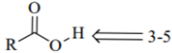
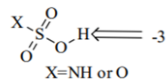
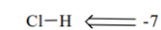
can't get $\ominus$ onto EWG NO_2
less stable conj. base $\rightarrow$ less acidic

Name: _____

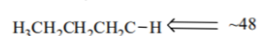
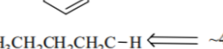
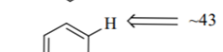
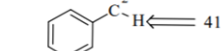
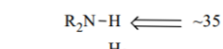
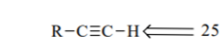
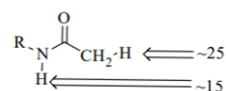
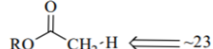
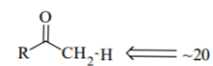
You have 50 minutes to complete Part 2 of the Exam.

IA																		0					
1 H 1.008	IIA																	2 He 4.003					
3 Li 6.941	4 Be 9.012																	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31																	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80						
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3						
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)						
87 Fr (223)	88 Ra (226.0)	89 Ac (227)	104 Rf	105 Ha	106 Unh	107 Uns	108	109 Une															

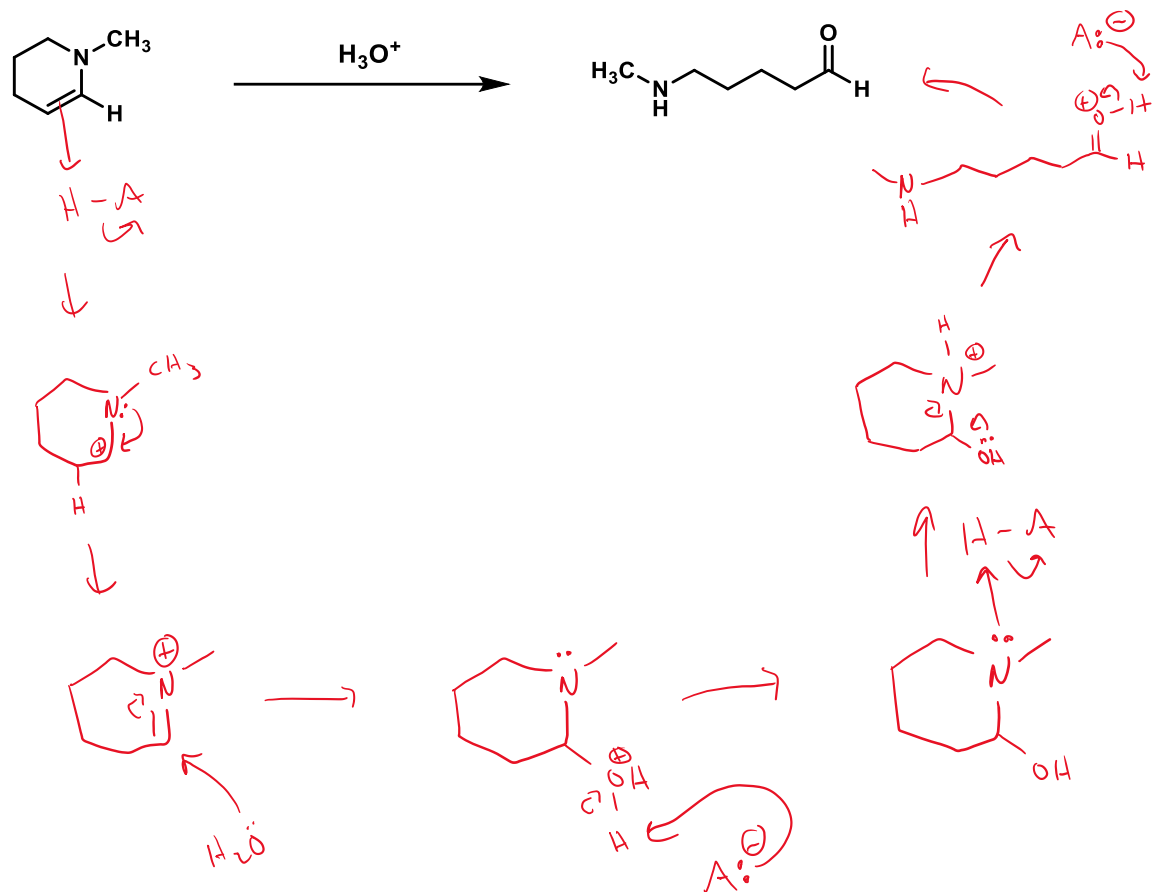
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** 90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

pK_a information

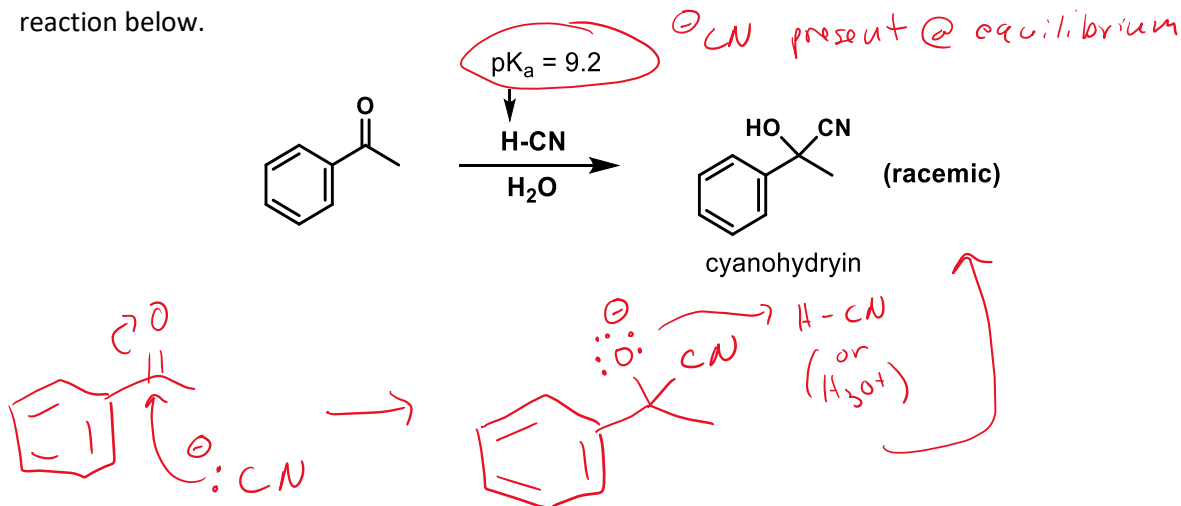
Note: R=alkyl



1. (12 pts) Draw the mechanism for the reaction below. If you require an acid, use H-A; if you require a base, use A⁻.

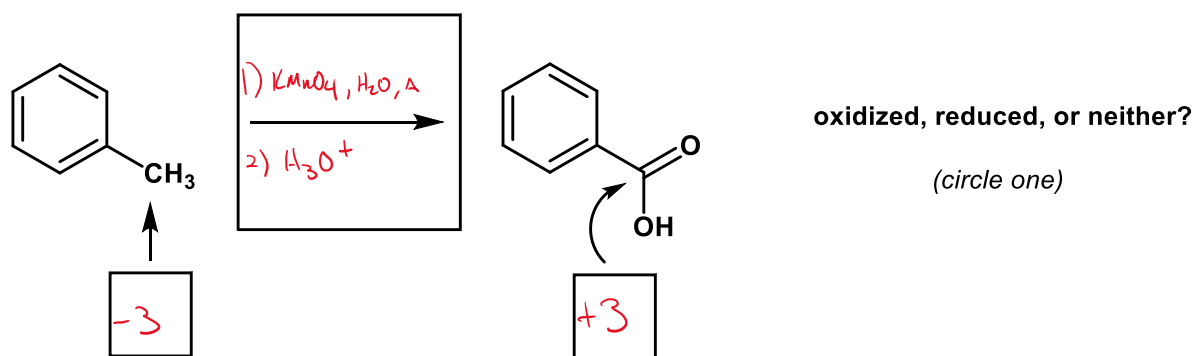
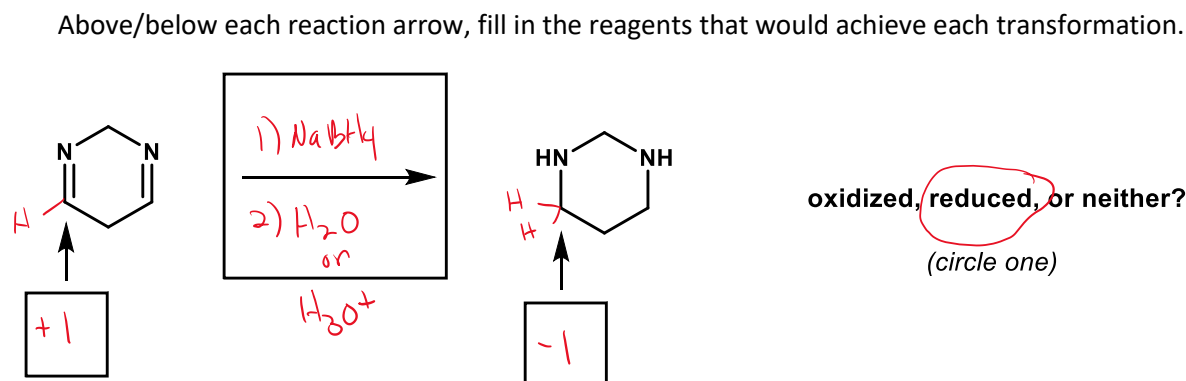


2. (5 pts) Ketones react with aqueous hydrogen cyanide to produce cyanohydrins, instead of the hydrate that is obtained when the ketone reacts with aqueous H₂SO₄. Propose a mechanism for the reaction below.

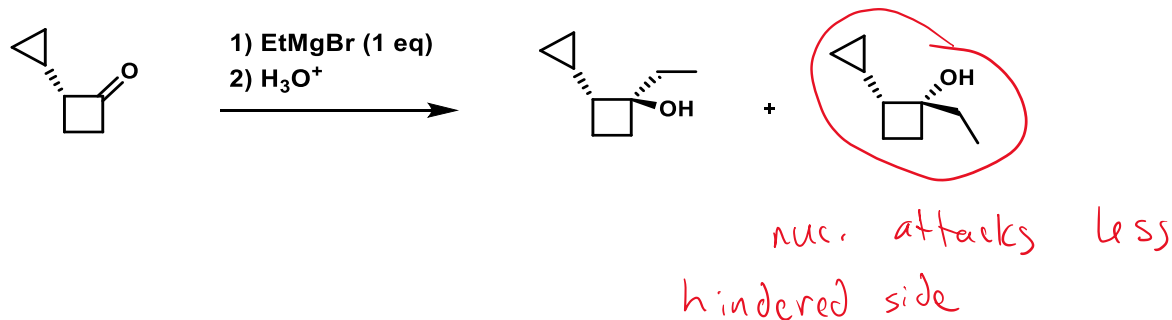


ok if you protonated ketone first.

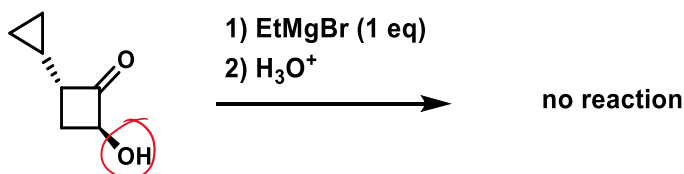
3. (12 pts) Fill in the oxidation states in the boxes below each atom indicated. Then, choose whether this atom was oxidized, reduced, or neither.



4. (7 pts) The Grignard reaction below does not produce an equal mixture of diastereomers, despite creating a new chiral center. Circle the diastereomer that you expect to be the major product, and briefly explain your choice.



When the starting material is altered slightly, no reaction is observed. Explain this observation.



alcohol is too acidic. Grignard will deprotonate instead of attacking carbonyl!

5. (12 pts) Using reactions we have discussed in class, propose a synthetic scheme for the overall transformation shown below.

