

NAME: \_\_\_\_\_

Email: \_\_\_\_\_

The exam must be **written in ink**. No calculators of any sort allowed. You have 3 hours to complete the exam.



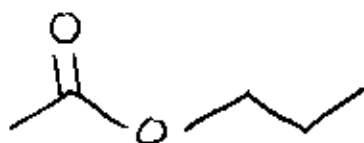
CHEM 610B; Final Exam; Spring 2002; Instructor: Dr. Brian Pagenkopf

	Page	Points
	2	10
	3	8
	4	4
	5	9
	6	9
	7	9
	8	9
	9	9
	10	24
Periodic table	11	0
	12	16
	13	14
	14	15
	15	10
	16	10
		156

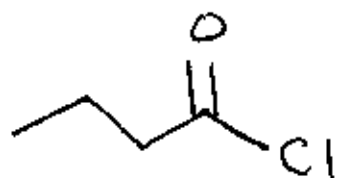
NAME: Key

(10 points) Nomenclature. Provide a structure for each of the following.

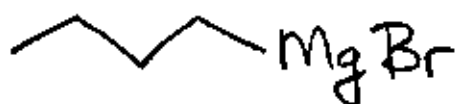
a. propyl ethanoate



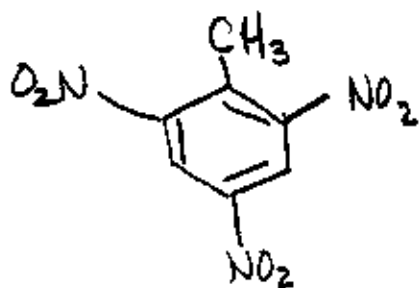
b. butanoyl chloride



c. butylmagnesium bromide

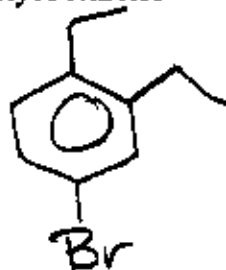


d. 2,4,6-trinitrotoluene



may use  throughout exam.  
for 

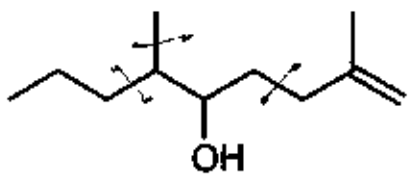
e. 4-bromo-1,2-diethylbenzene



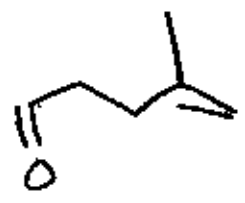
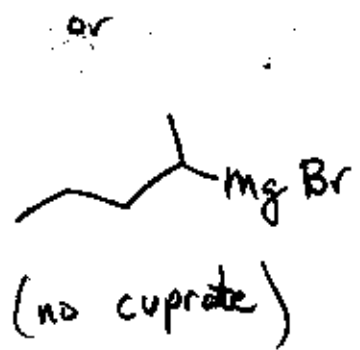
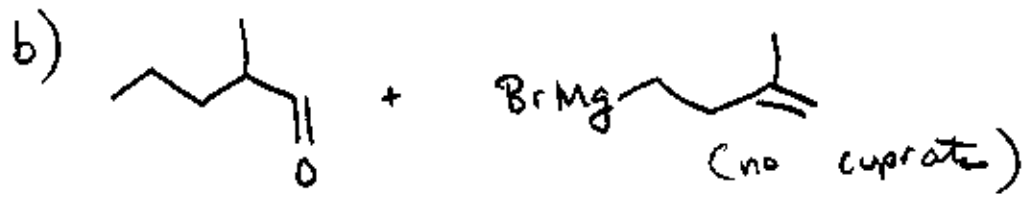
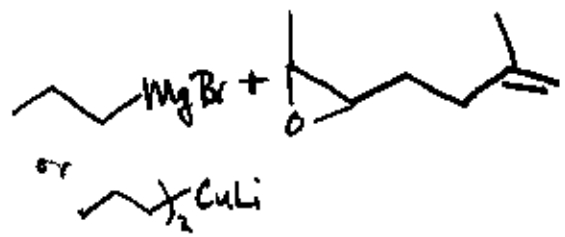
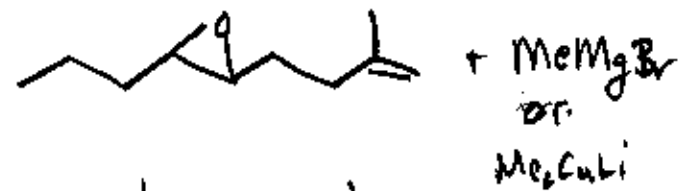
(8 points) Both of the following reactions can be used to prepare the alcohol shown below.

- a) epoxide + organometallic reagent → alcohol
- b) aldehyde or ketone + organometallic reagent → alcohol

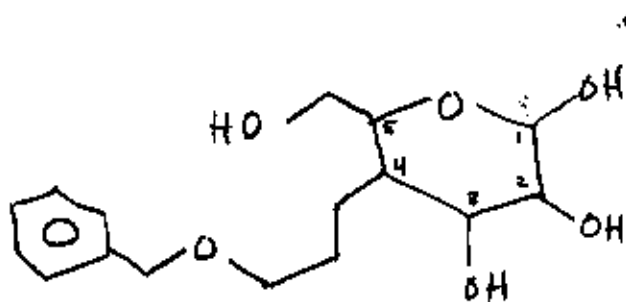
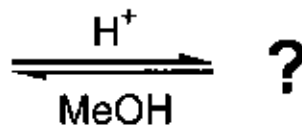
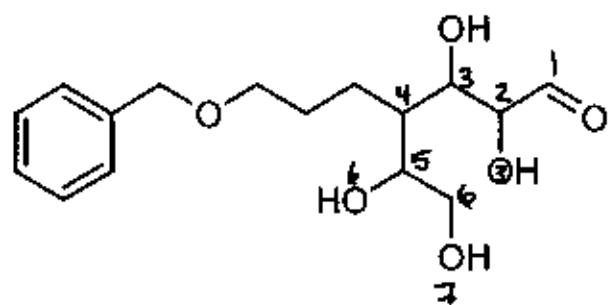
Propose two syntheses for the following molecule starting from a) an epoxide and b) an aldehyde or ketone. Don't forget sterics in designing your answer.



poor choices:  
(not full credit)

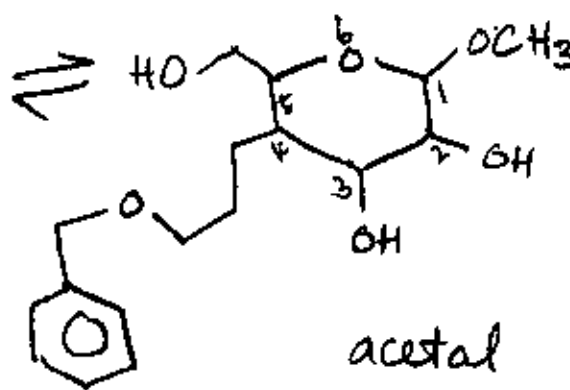


(4 points) Draw the most stable (thermodynamic) *acetal* for the following molecule. You may ignore stereochemistry.



hemi-acetal

(not full credit)



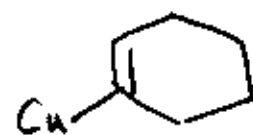
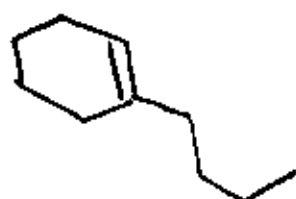
acetal

(45 points) Show the expected products from the following reactions. You may assume the reaction is finished with a standard workup if needed. Show any product(s) that contains a carbon atom.

a.

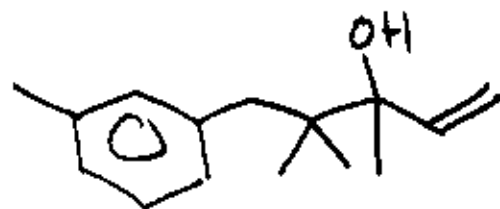
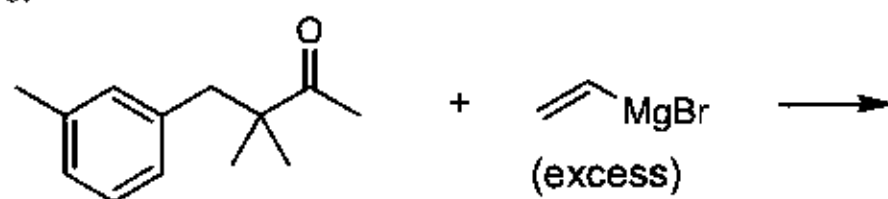


(excess)

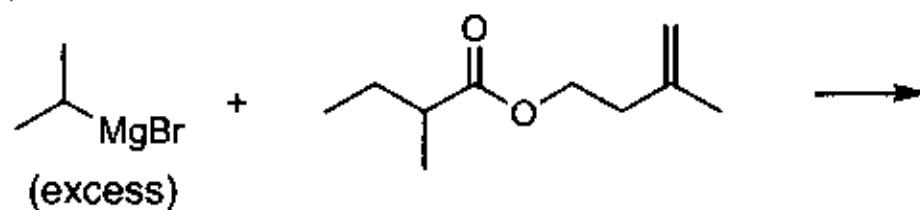


(not necessary to show)

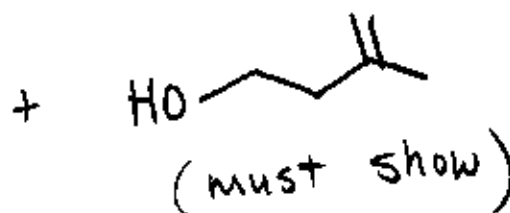
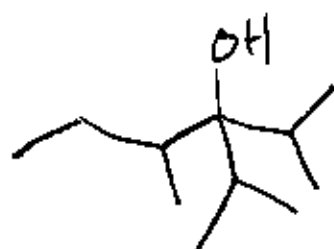
b.



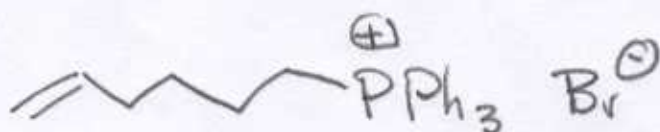
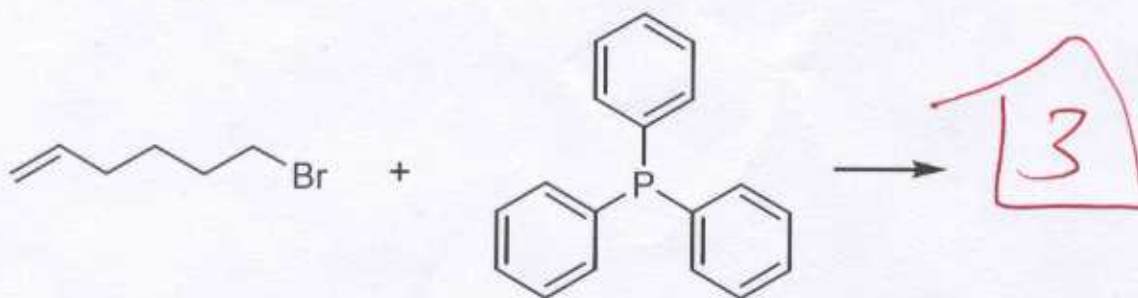
c.



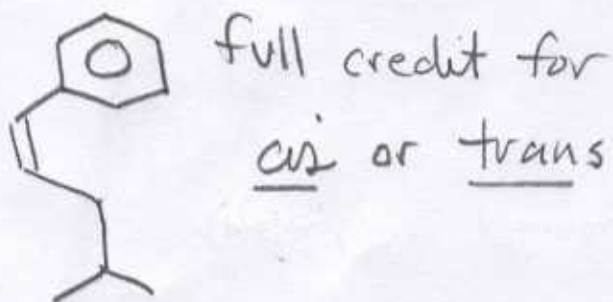
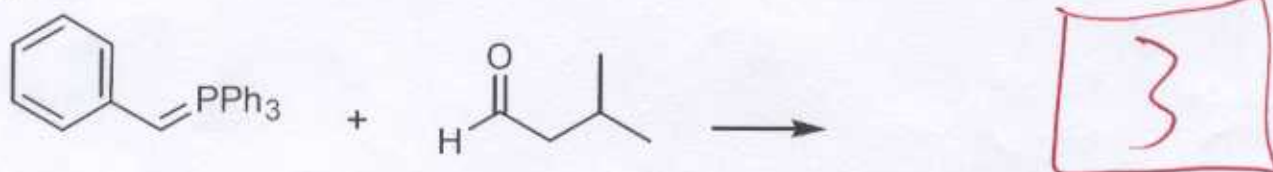
(excess)



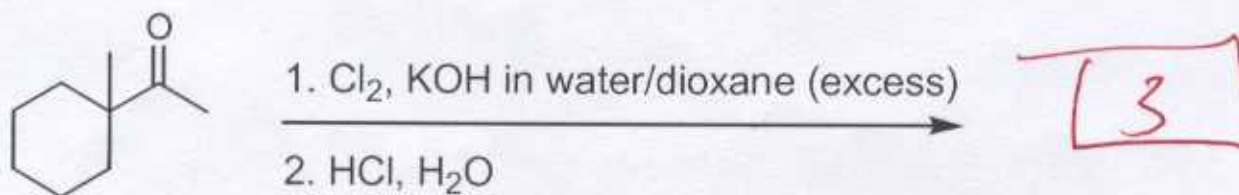
d.



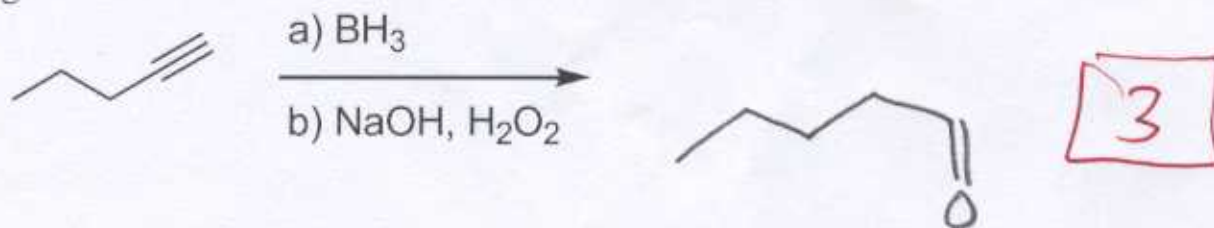
e.



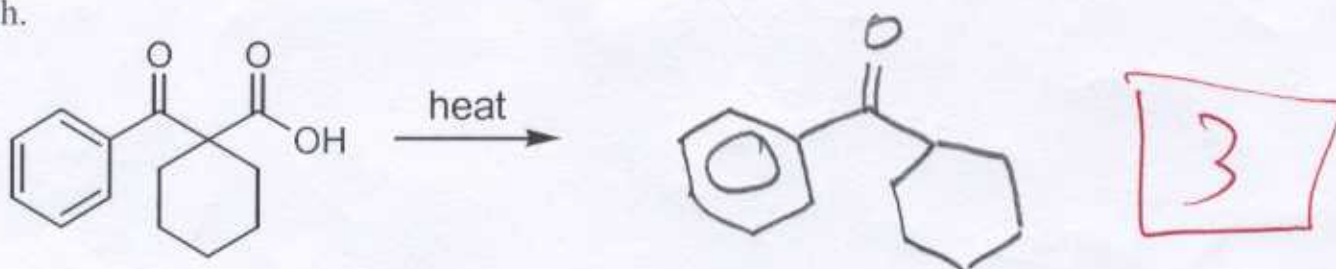
f.



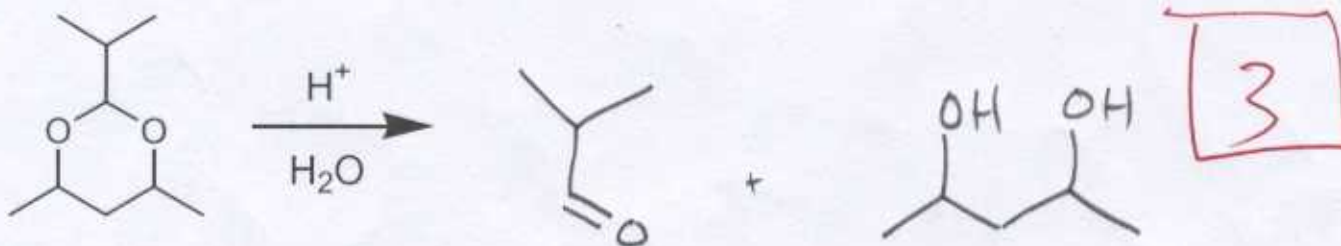
g.



h.

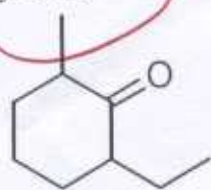


i.

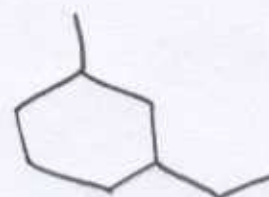
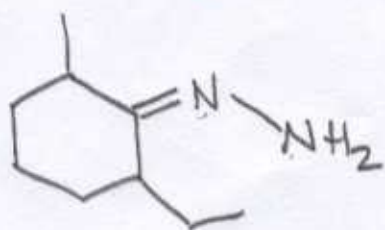


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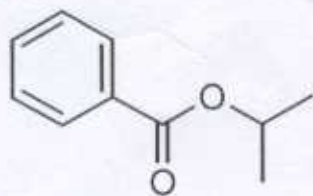
j. & k.



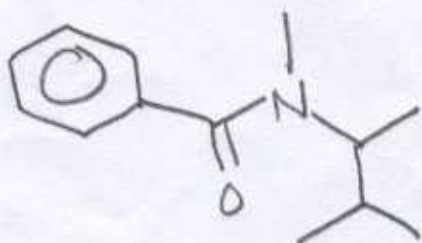
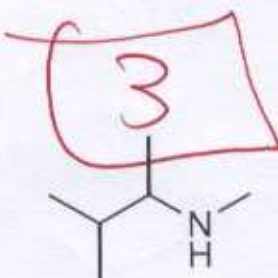
3 + 3



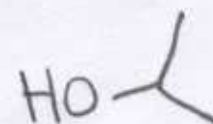
1.



+

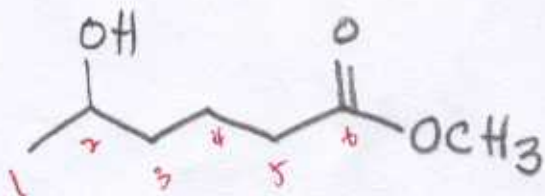
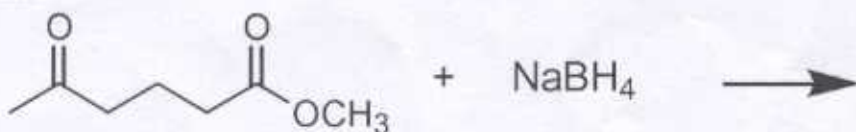


+



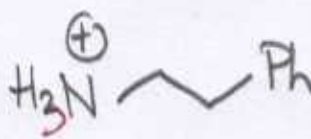
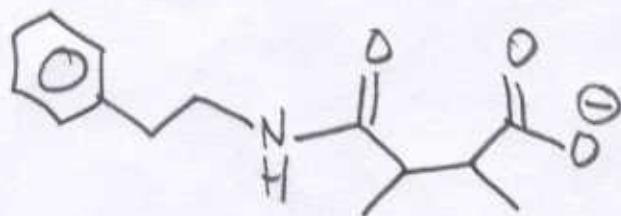
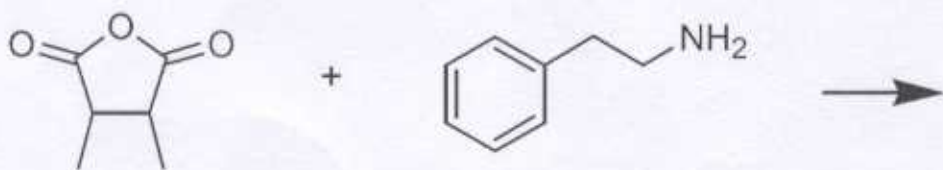


m.



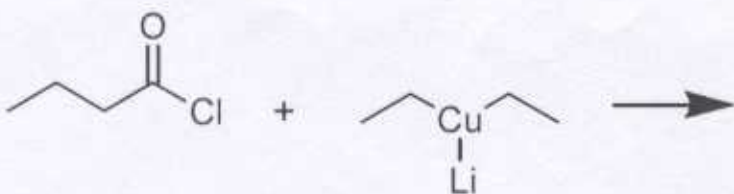
3

n.

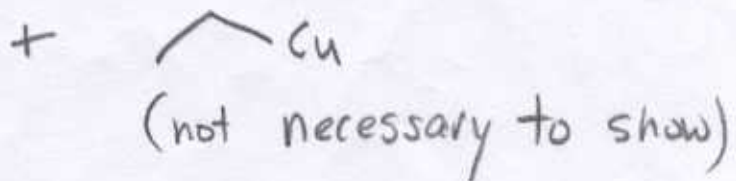
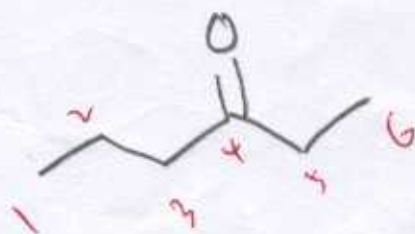


3

o.



3

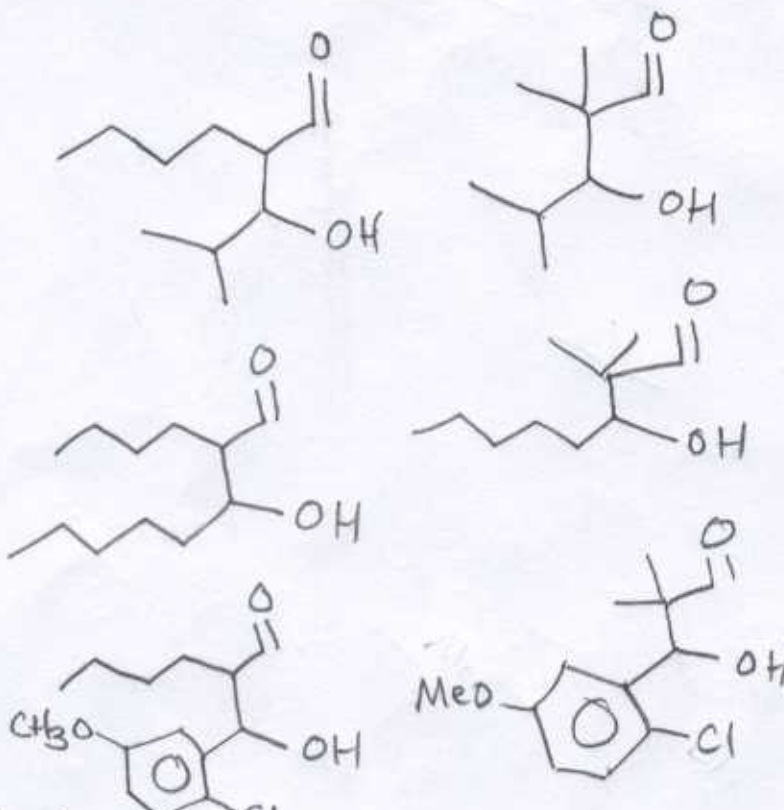
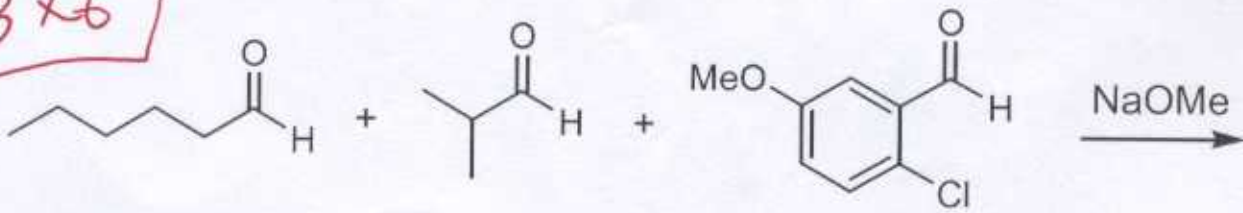


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Key

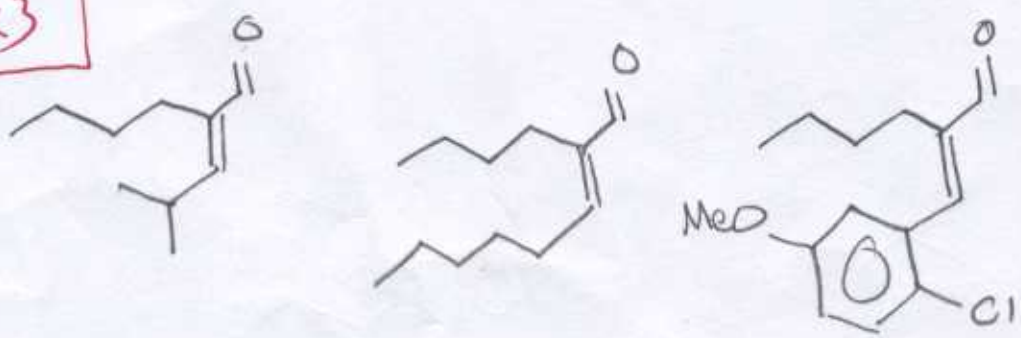
(24 points). Show all the possible aldol products (as  $\beta$ -hydroxy carbonyl compounds) from the following reaction mixture:

3x6



When possible, dehydrate the above products and show the corresponding  $\alpha,\beta$ -unsaturated compounds.  
(There's additional space on the next page).

2x3



← stereochemistry doesn't matter

NAME: \_\_\_\_\_

No question this page.

**PERIODIC TABLE OF THE ELEMENTS**

Atomic masses are based on <sup>12</sup>C. Atomic masses in parentheses are for the most stable isotope.

1																	2
H 1.0079																	He 4.0026
3	4											5	6	7	8	9	10
Li 6.941	Be 9.0122											B 10.81	C 12.011	N 14.007	O 15.999	F 18.998	Ne 20.179
11	12											13	14	15	16	17	18
Na 22.990	Mg 24.305											Al 26.982	Si 28.086	P 30.974	S 32.06	Cl 35.45	Ar 39.948
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K 39.098	Ca 40.08	Sc 44.956	Ti 47.88	V 50.942	Cr 51.996	Mn 54.938	Fe 55.845	Co 58.933	Ni 58.69	Cu 63.546	Zn 65.38	Ga 69.723	Ge 72.63	As 74.922	Se 78.96	Br 79.904	Kr 83.80
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb 85.468	Sr 87.62	Y 88.906	Zr 91.224	Nb 92.906	Mo 95.94	Tc (98)	Ru 98.906	Rh 101.07	Pd 106.36	Ag 107.868	Cd 112.411	In 114.818	Sn 118.710	Sb 121.757	Te 127.60	I 126.905	Xe 131.29
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Cs 132.905	Ba 137.33	La 138.905	Ce 140.12	Pr 140.908	Nd 144.24	Pm (145)	Sm 150.36	Eu 151.964	Gd 157.25	Tb 158.925	Dy 162.50	Ho 164.930	Er 167.259	Tm 168.930	Yb 173.054	Lu 174.967	
87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104
Fr (223)	Ra (226)	Ac (227)	Th 232.038	Pa 231.036	U 238.029	Np 237.048	Pu (244)	Am (243)	Cm (247)	Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)	Lr (260)	

**Lanthanide series**

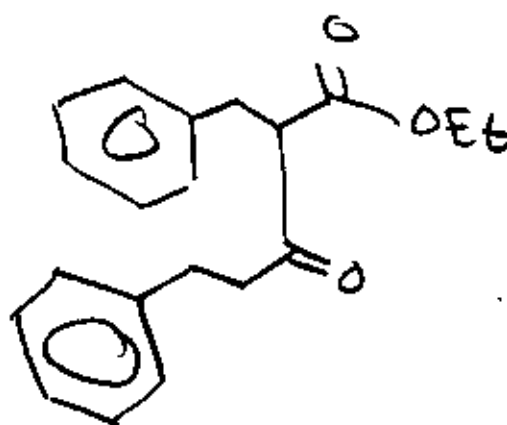
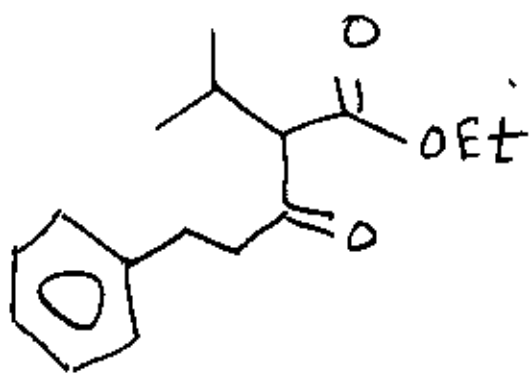
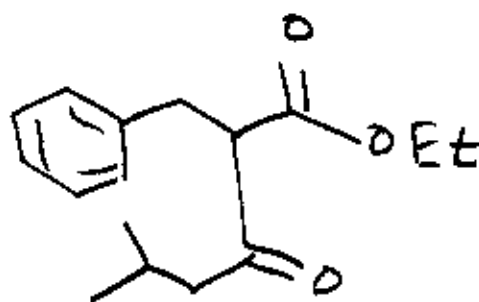
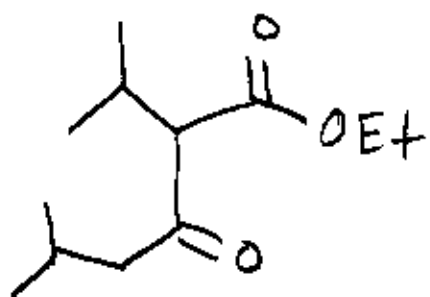
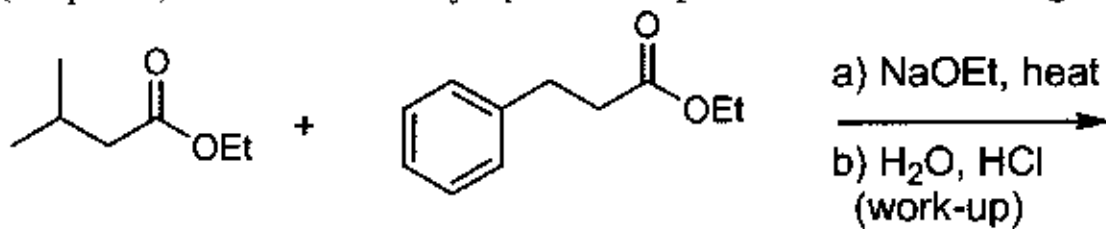
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La 138.905	Ce 140.12	Pr 140.908	Nd 144.24	Pm (145)	Sm 150.36	Eu 151.964	Gd 157.25	Tb 158.925	Dy 162.50	Ho 164.930	Er 167.259	Tm 168.930	Yb 173.054	Lu 174.967

**Actinide series**

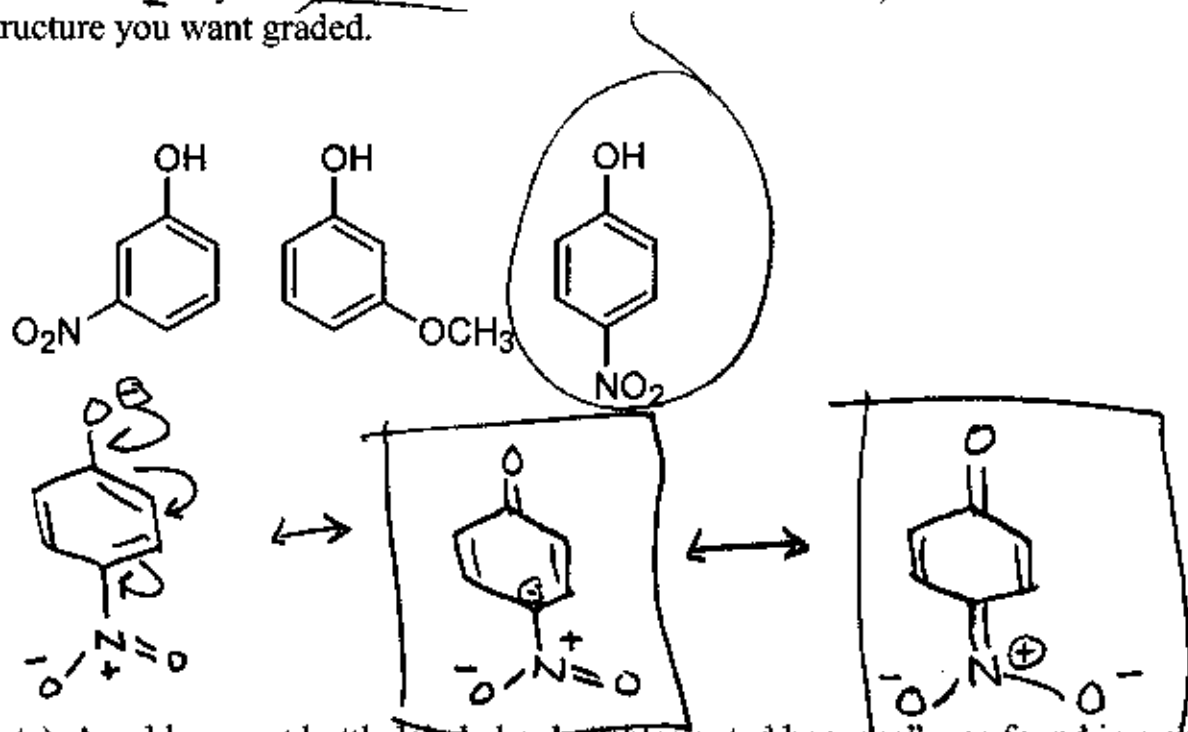
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th 232.038	Pa 231.036	U 238.029	Np 237.048	Pu (244)	Am (243)	Cm (247)	Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)	Lr (260)	

NAME: \_\_\_\_\_

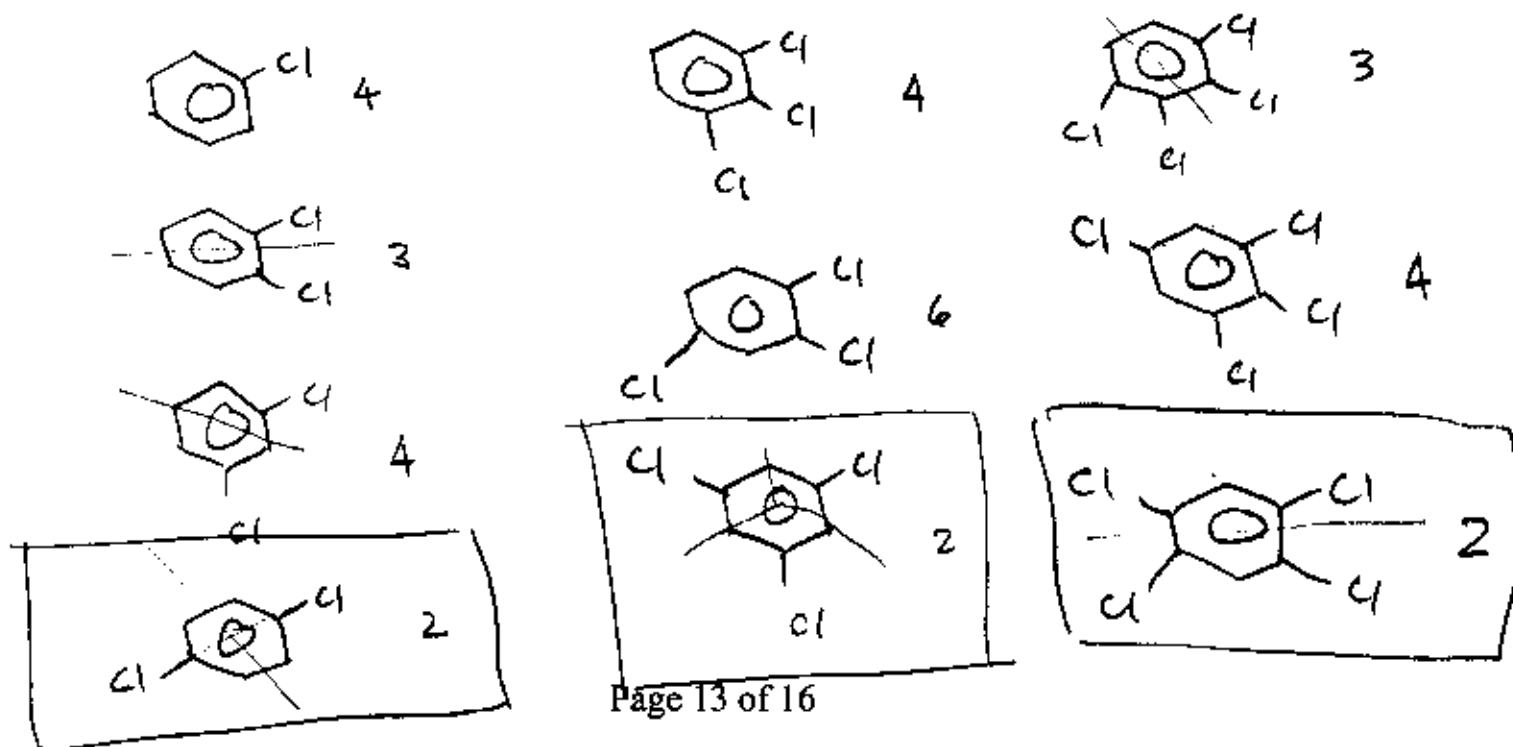
(16 points). Draw the four major products expected from the following Claisen reaction.



(6 points). For the following series, a) circle the most acidic phenol, and then b) for the structure you circled, show the most important resonance structure that helps explain the increased acidity. If you write more than one resonance structure, then draw a box around the one structure you want graded.

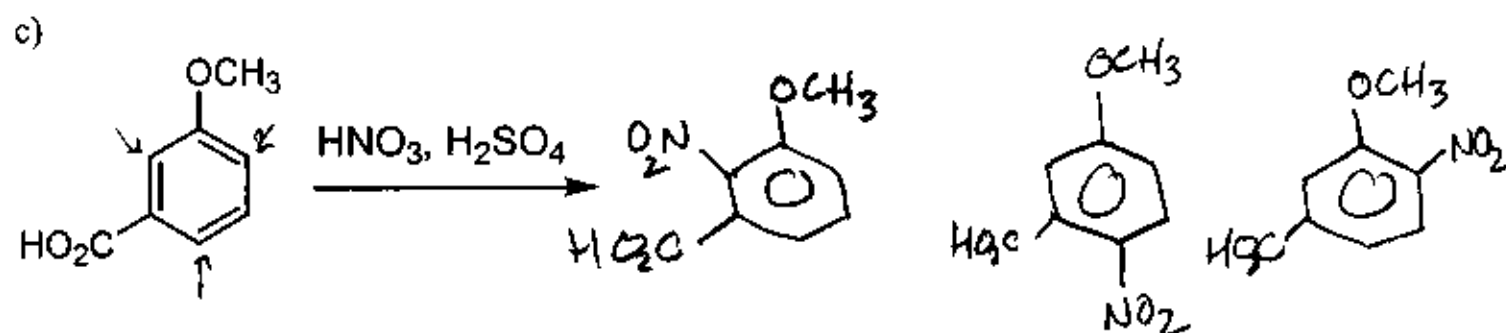
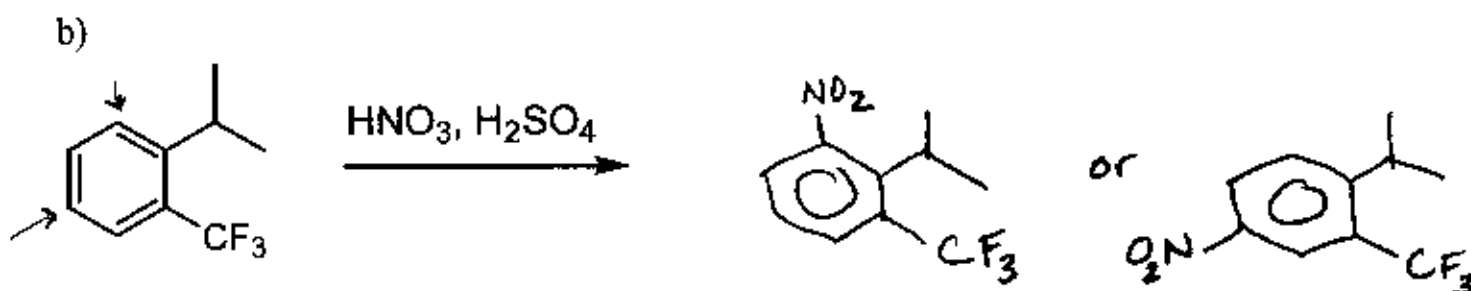
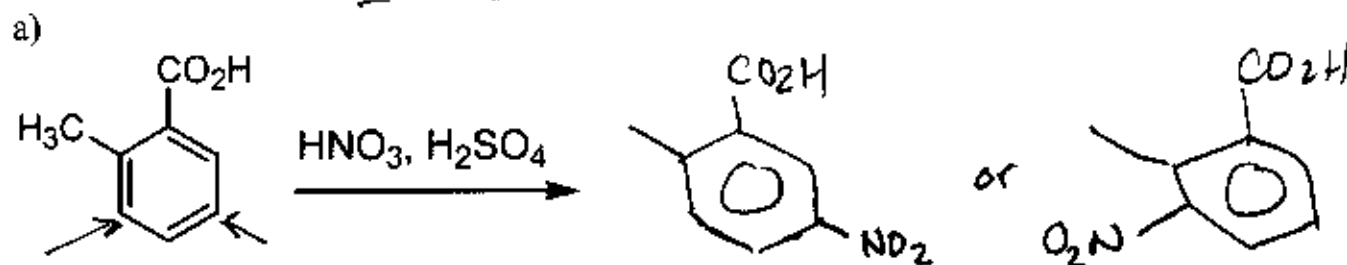


(8 points). An old reagent bottle labeled only "chlorinated benzene" was found in a chemical storage cabinet. Tests showed that the bottle contained a pure compound, and the  $^{13}\text{C}$  NMR spectrum showed only two peaks. There are several possibilities for the identity of the compound, and given the information provided you can not be sure which one it is (so there are several right answers to this question). Propose one structure for what is in the bottle. If you draw more than one structure, then draw a box around the one structure you want graded.



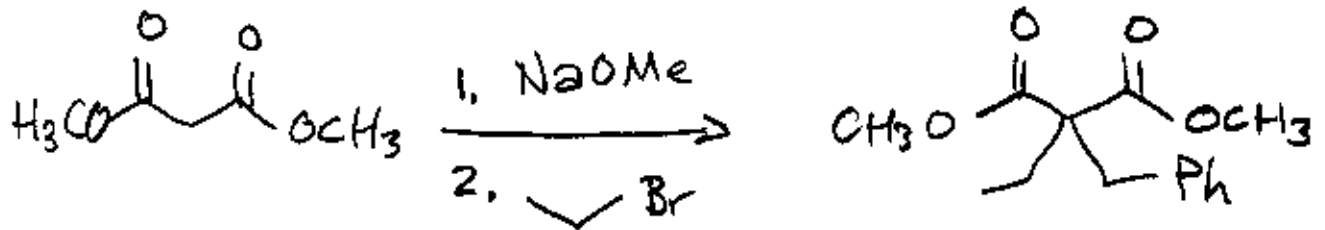
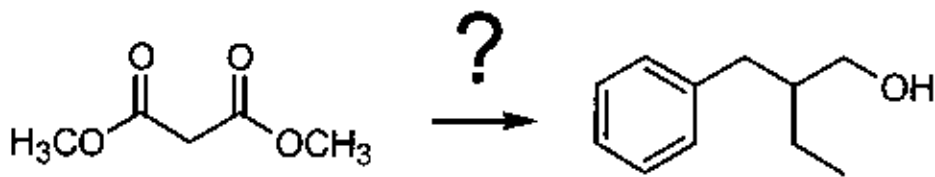
(15 points). Electrophilic aromatic substitution reactions. Draw the major product expected from each of the following reactions. For each nitration reaction, add only one nitro group to the aromatic ring.

*no credit for other structures*



NAME: \_\_\_\_\_

(10 points) Synthesis. Show how to convert dimethyl malonate into the product shown.

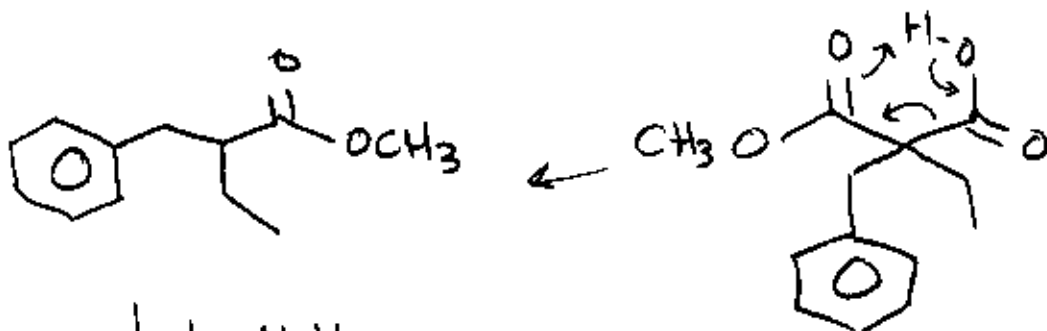


3. NaOMe

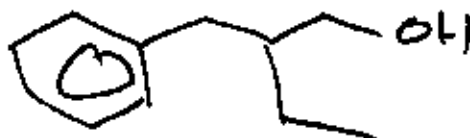
4.



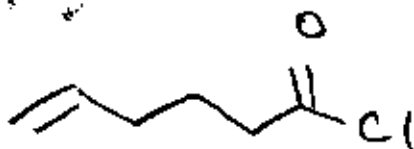
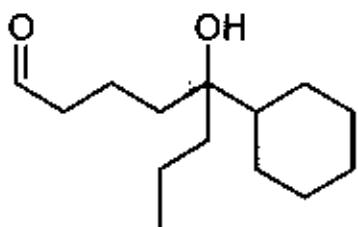
↓  
1 eq  
NaOH  
then HCl



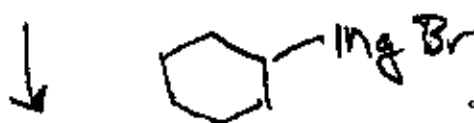
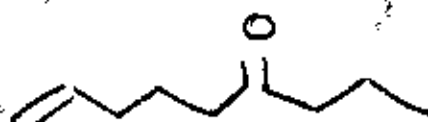
↓ LiAlH<sub>4</sub>



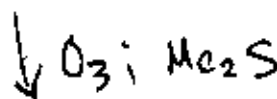
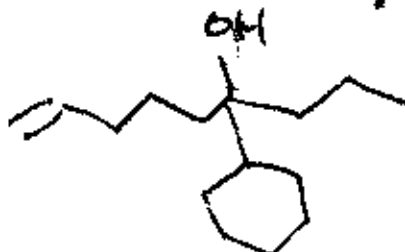
(10 points) Propose a synthesis of the following molecule starting from anything with 6 carbons or less. You may use any reagents you wish provided they add only 6 carbons or less to the final product.



1.



2.



3.

