

6 — Atomic number
C — Symbol
12.011 — Atomic mass

Groups
1A
2
IIA
IIIA
IVA
VA
VIA
VIIA
VIII

Periods
1
2
3
4
5
6
7

PERIODIC TABLE OF THE ELEMENTS

Atomic masses are based on ^{12}C . Atomic masses in parentheses are for the most stable isotope.

1 H 1.0079	2 He 4.00260																										
3 Li 6.941	4 Be 9.01218	5 B 10.81	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.998403	10 Ne 20.179																				
11 Na 22.98977	12 Mg 24.305	13 Al 26.98154	14 Si 28.0855	15 P 30.97376	16 S 32.06	17 Cl 35.453	18 Ar 39.948																				
19 K 39.0983	20 Ca 40.08	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.70	29 Cu 63.546	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80										
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9058	40 Zr 91.22	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.4	47 Ag 107.868	48 Cd 112.41	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.30										
55 Cs 132.9054	56 Ba 137.33	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.09	79 Au 196.9665	80 Hg 200.59	81 Tl 204.37	82 Pb 207.2	83 Bi 208.9804	84 Po (209)	85 At (210)	86 Rn (222)										
87 Fr (223)	88 Ra 226.0254	89 Ac 227.0278	104 Unq (261)	105 Unp (262)	106 Unh (263)																						

*Lanthanide series

58 Ce 140.12	59 Pr 140.9077	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.96	64 Gd 157.25	65 Tb 158.9254	66 Dy 162.50	67 Ho 164.9304	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.967
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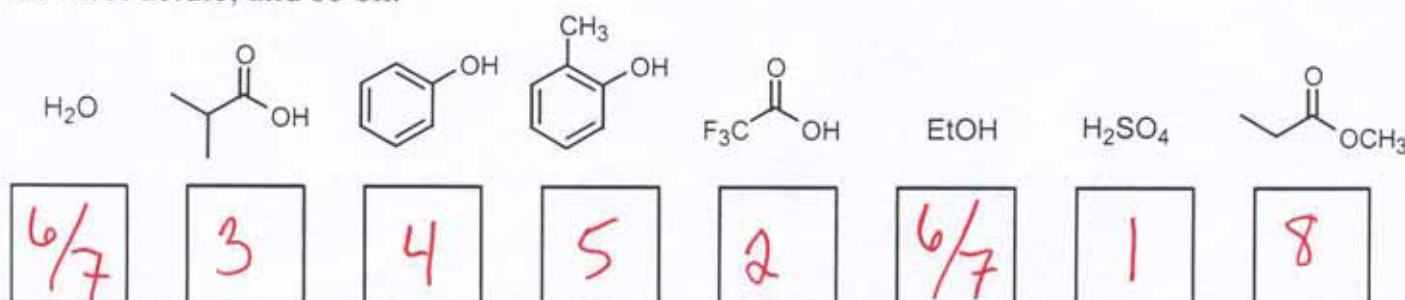
*Actinide series

90 Th 232.038	91 Pa 231.0358	92 U 238.029	93 Np 237.0482	94 Pu (244)	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)
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Question 1. (2 points). What is the most important question in organic chemistry?

Where are the electrons going?

Question 2. a. (2 points). Rank the following molecules in order of increasing acidity (which is the same as decreasing pKa). Write a 8 in the box for the least acidic, a 1 in the box under the most acidic, and so on.



NAME: _____

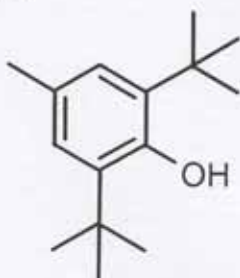
(5 points) Nomenclature. Name the following.

a.



1-ethyl-2-isopropyl hydroxy cyclopropane

b.



2,6-di-tert butyl-4-methyl-phenol

Draw the following.

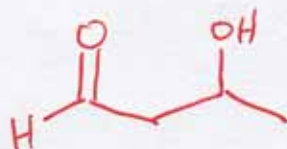
c. ethynylbenzene



d. benzylalcohol

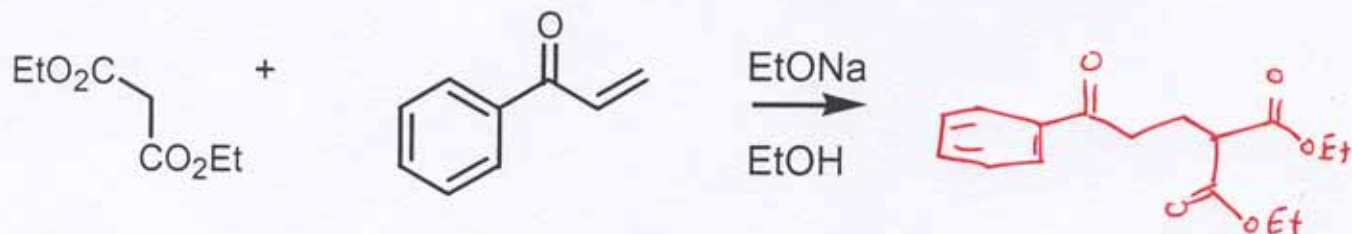


e. 3-hydroxybutanal

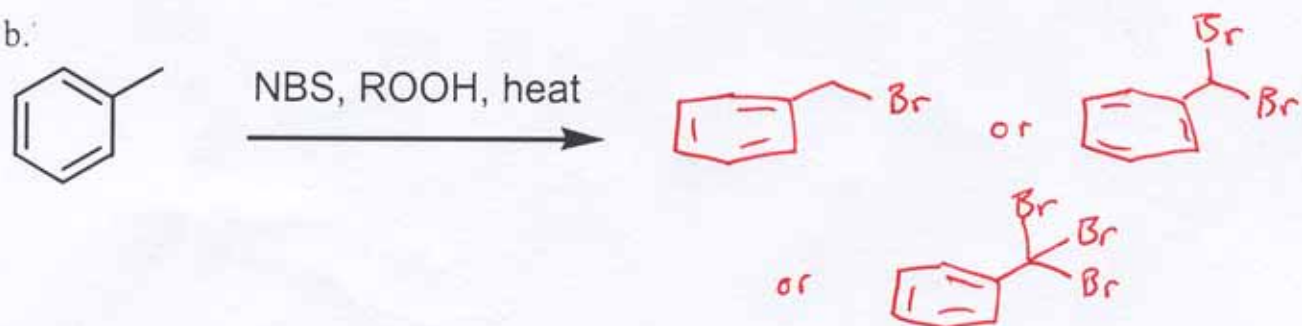


Question 3. (18 points) Show the expected products from the following reactions. You may assume the reaction is finished with a standard workup if needed. Show any product(s) that contains a carbon atom.

a.

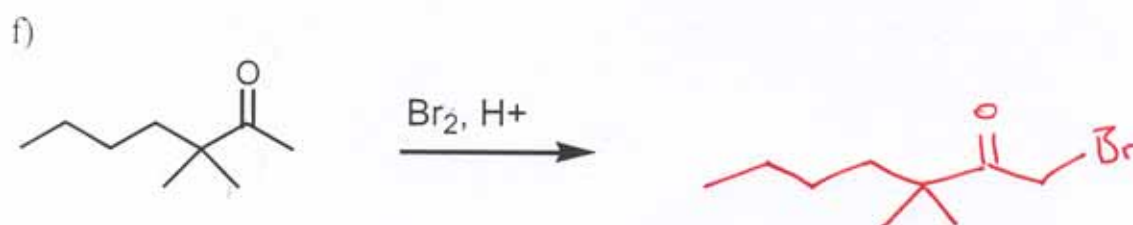
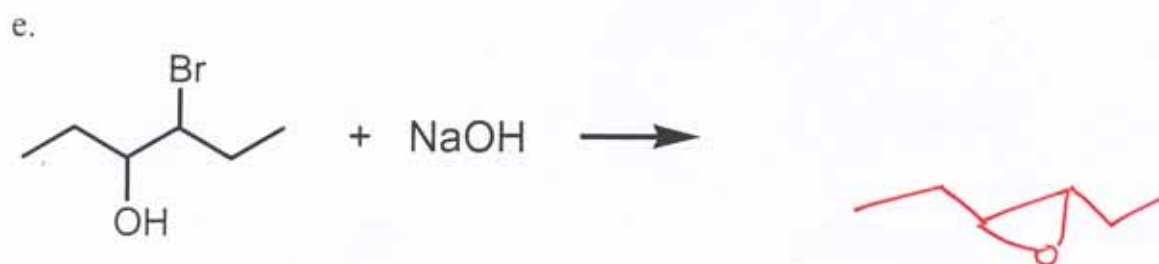
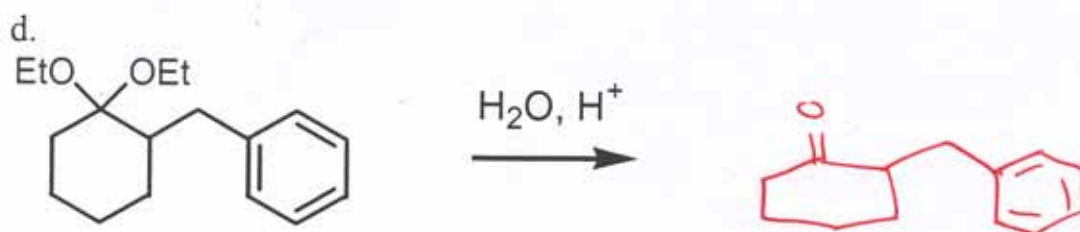


b.



c.



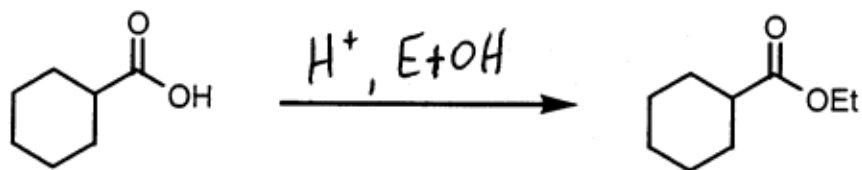


Haloform reaction needs basic conditions pg 582-3

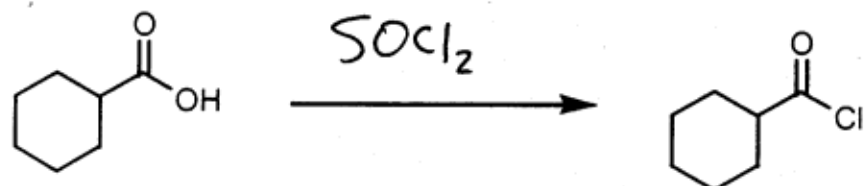
NAME: _____

Question 4. (18 points) Provide the Reagents necessary to convert cyclohexanecarboxylic acid to the products shown. Some reactions might require more than one step.

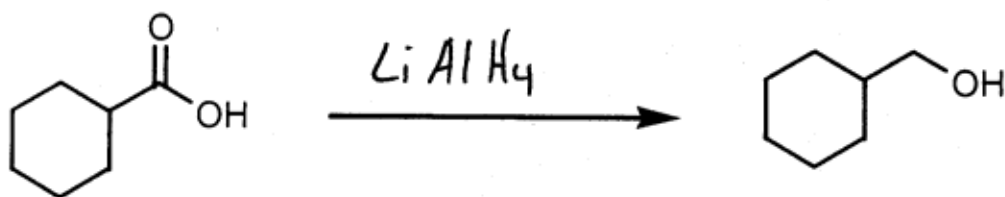
a.



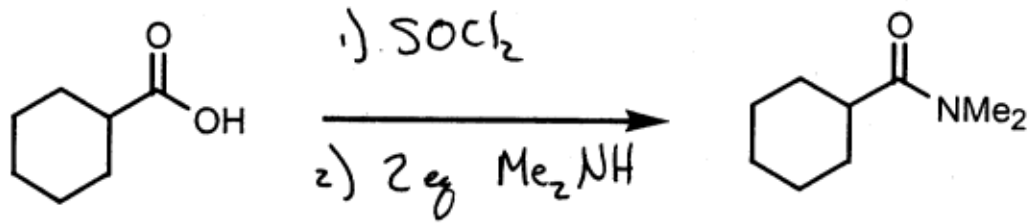
b.



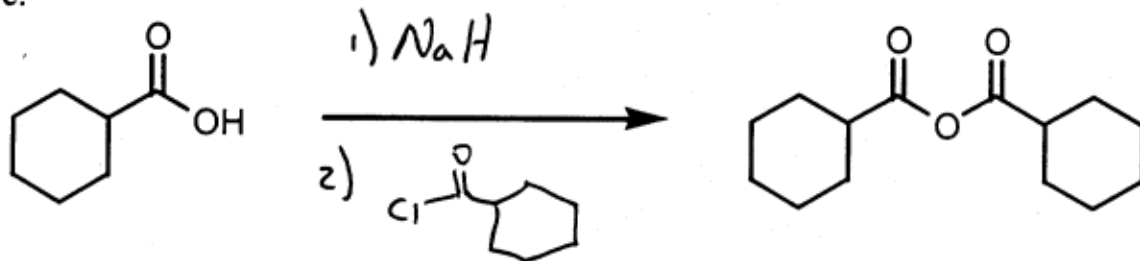
c.



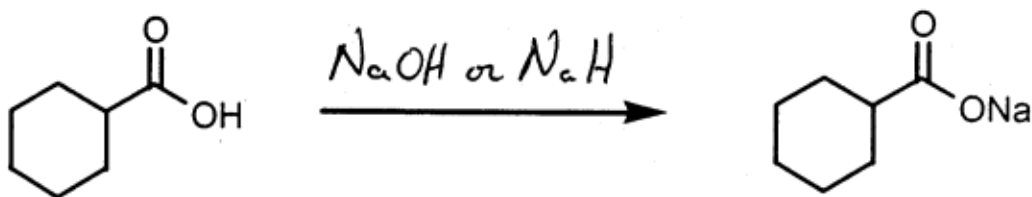
d.



e.

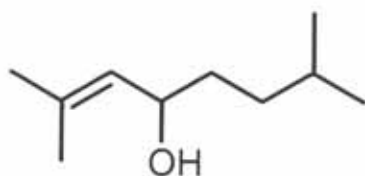


f.

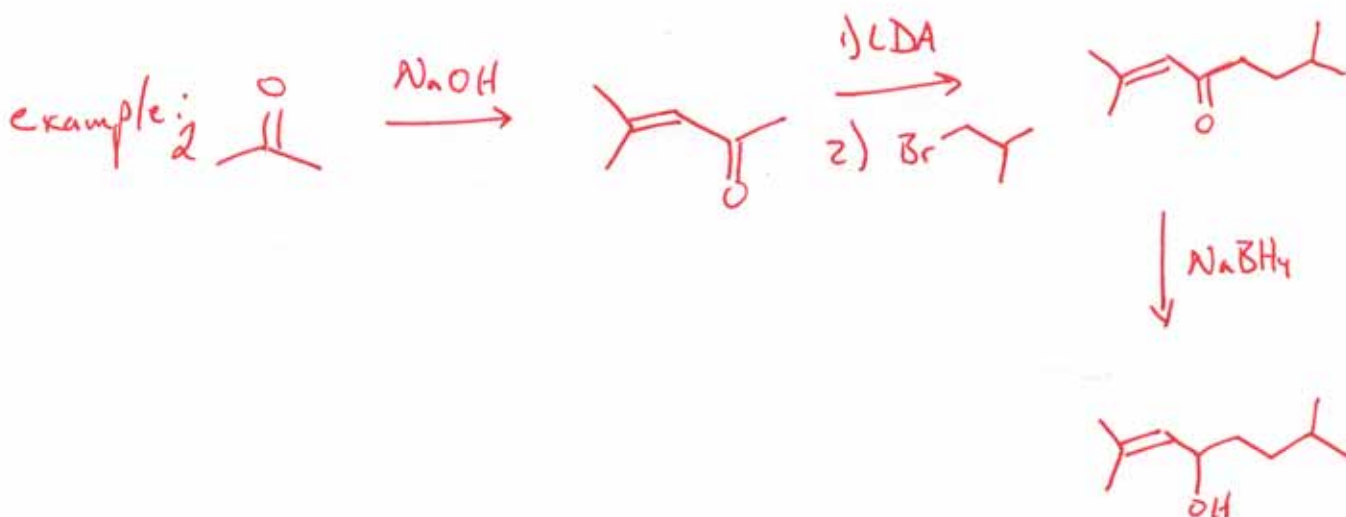


NAME: _____

Question 5. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.

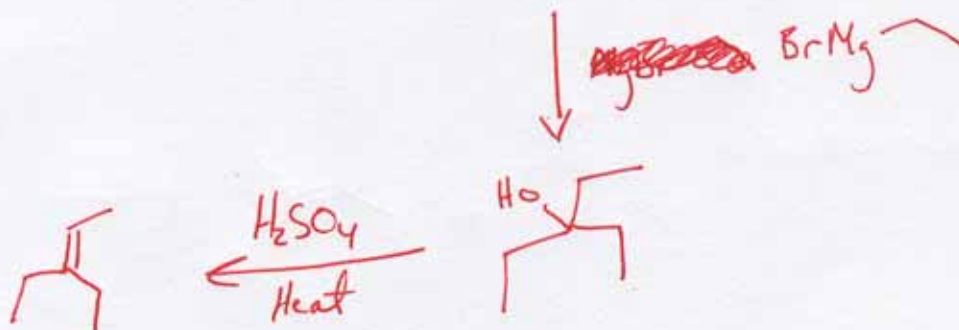
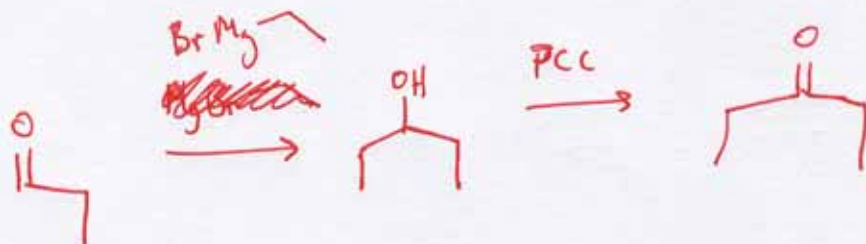
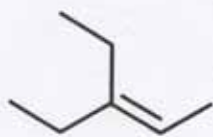


Synthesis questions have many correct answers.



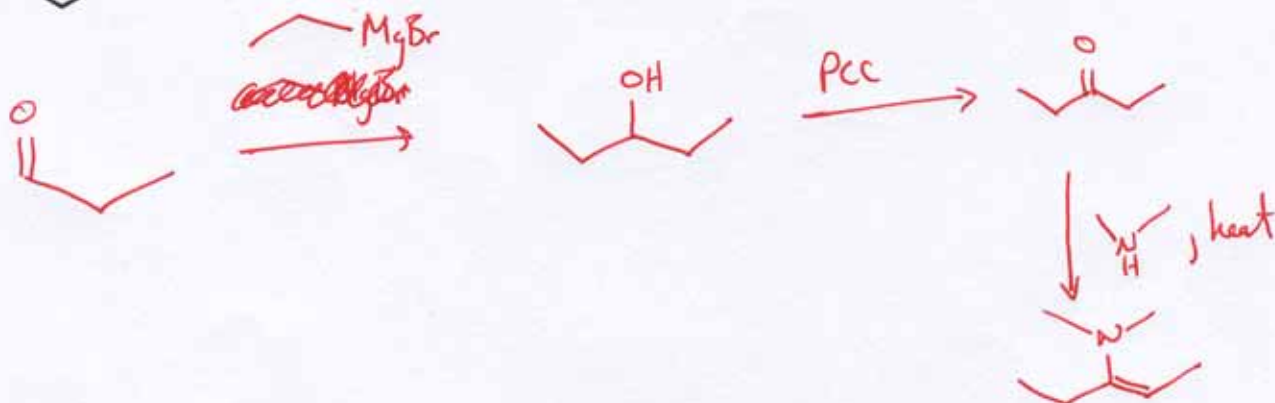
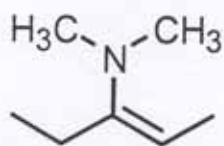
NAME: _____

Question 6. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



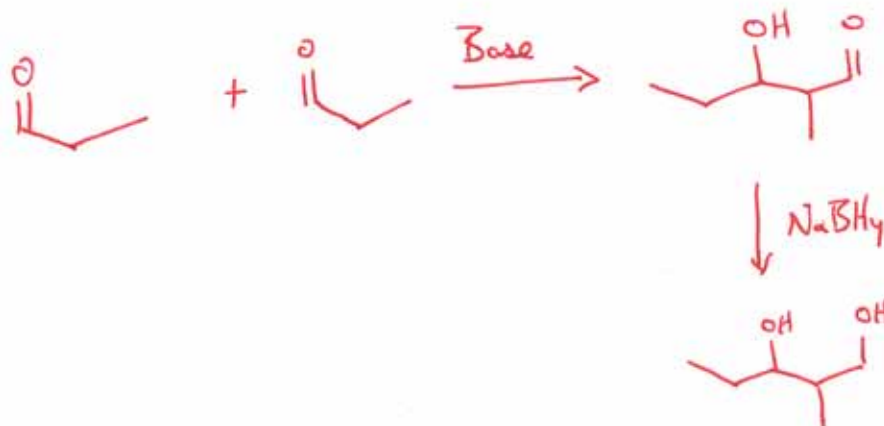
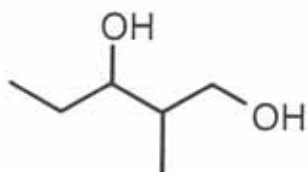
NAME: _____

Question 7. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



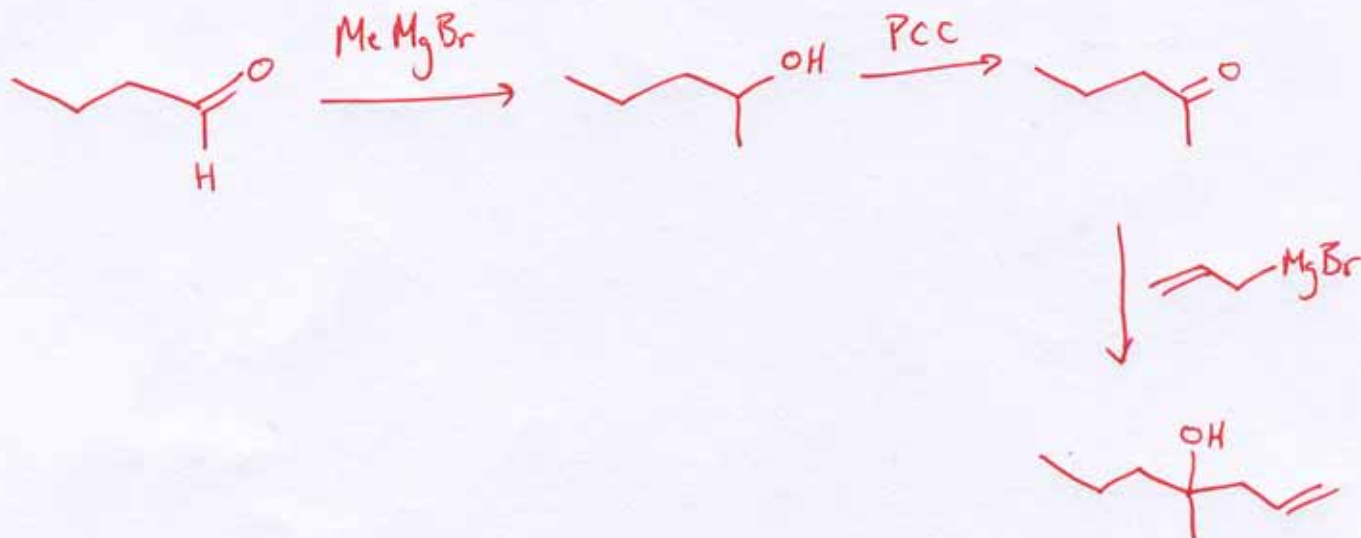
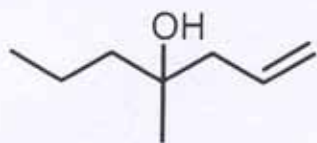
NAME: _____

Question 8. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



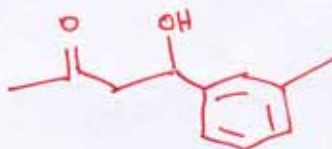
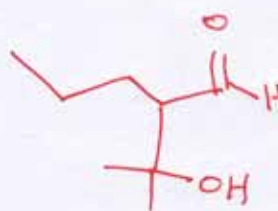
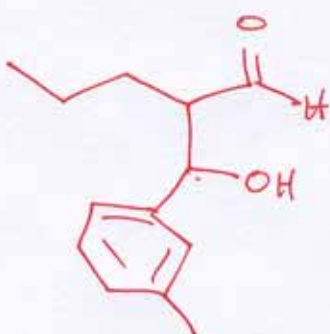
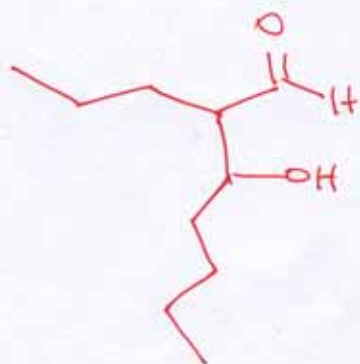
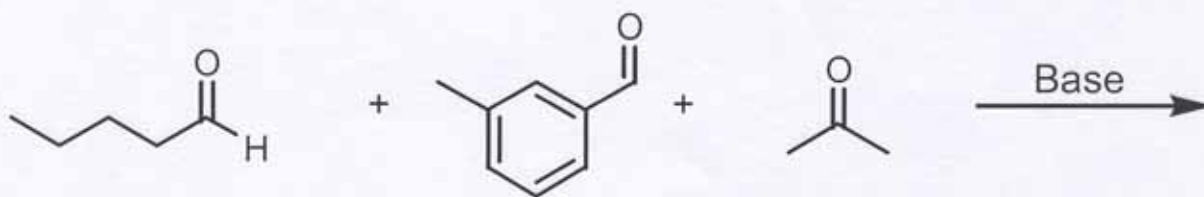
NAME: _____

Question 9. (10 points) Synthesis. Propose a synthesis of the following compound from any organic materials you choose with the restrictions that your starting material must be **four** carbons or less and each reagent can not add more than four carbons to the product. You may use any other reagents you want.



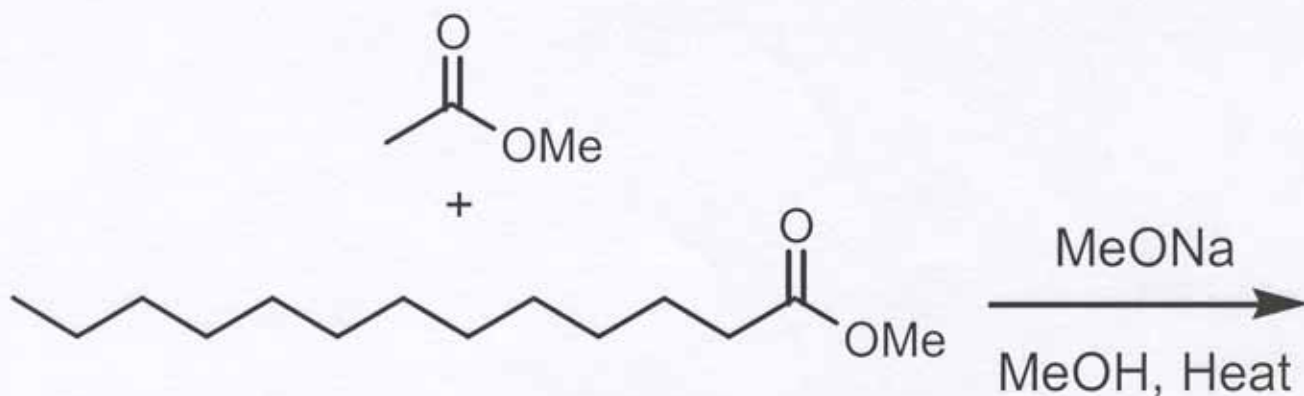
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Question 10. (6 points). Draw all the beta-hydroxy aldehyde or ketone products from aldol reaction among the following compounds. Only show aldol products between two molecules.

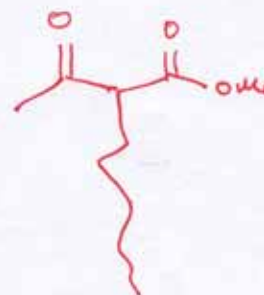
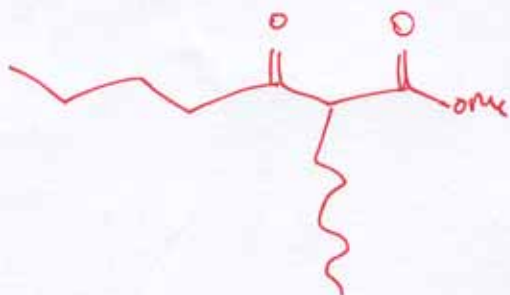


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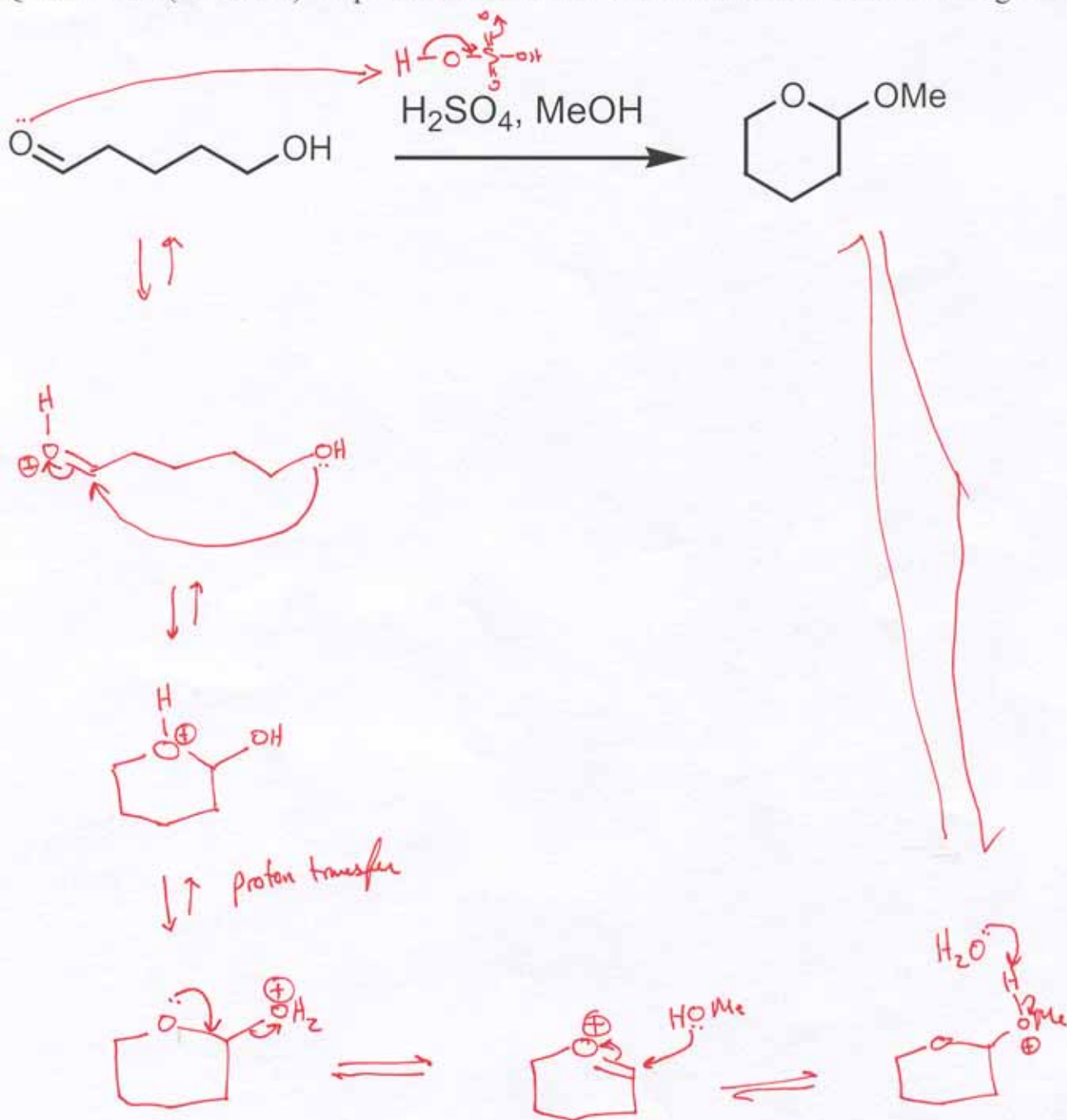
Question 11. (8 points) Draw structural formulas of all four Claisen condensation products.



2 points each

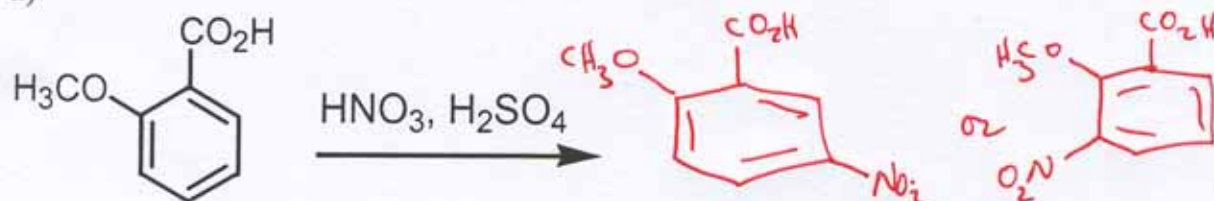


Question 12. (10 Points) Propose a detailed reaction mechanism for the following reaction.

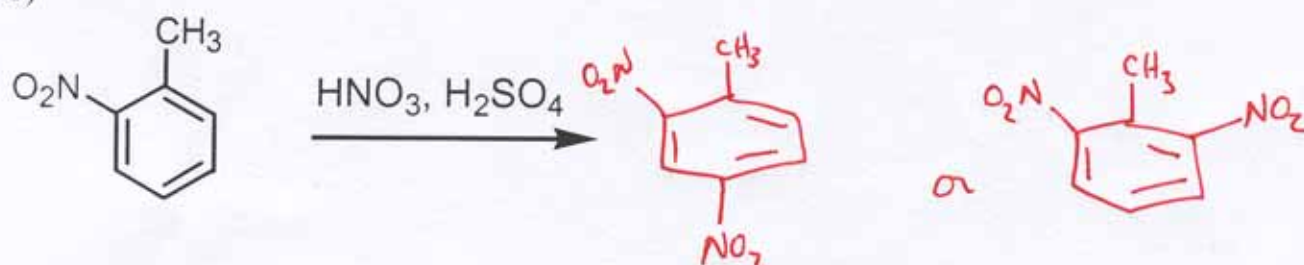


Question 13. (9 points). Draw the major product expected from each of the following reactions. For each nitration reaction, add only one nitro group to the aromatic ring.

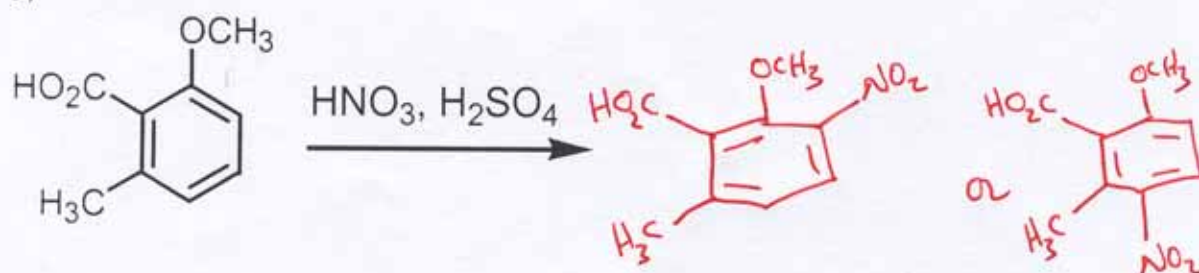
a)



b)



c)



Miscellaneous Questions.

Question 14. (1 point) What does NMR stand for?

Nuclear Magnetic Resonance

Question 15. (1 point) NMR uses radiation from what part of the electromagnetic spectrum?

Radio- Frequency $\sim 10^6$ Hz

Question 16. (1 point) In a modern NMR the magnetic field stays constant. What is changing or going on when a signal is said to resonate "up field"?

Some parameter is changing other than the magnetic field to cause upfield resonance.

Question 17. (1 point) If someone asks you whether he or she should be afraid of MRI (magnetic resonance imaging, like NMR) because of radioactivity concerns, you can explain:

MRI is not radioactive

Question 18. (3 points) What are Hückels criteria for aromaticity?

Pg. 753

- 1) Be cyclic
- 2) Have one p orbital on each atom in the ring
- 3) planar
- 4) $4n+2$ pi electrons

Question 19. (1 point) What's the one thing you would most like to see changed in organic chemistry class to make it more interesting?

No Graded Homework