1st Letter of Last Name

NAME:

610B Exam Cover Page

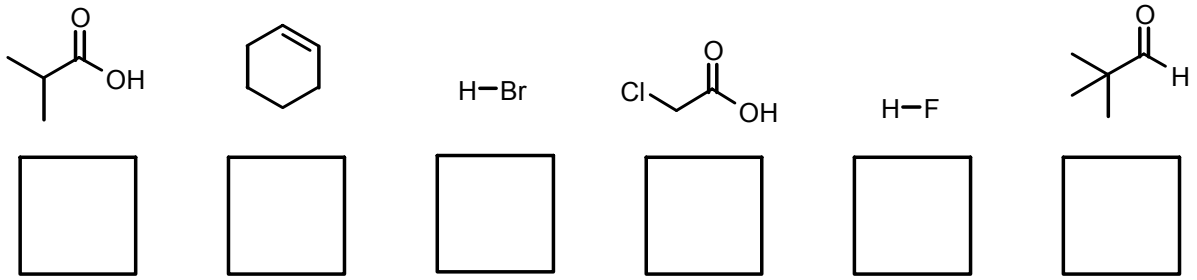
To be eligible for a regrade, the exam must be written in *ink*.
No calculators of any sort allowed.
You have 3 hours to complete the exam.

CHEM 610B, 50995
Exam 2
Fall 2003
Instructor: Dr. Brian Pagenkopf
Email:_____

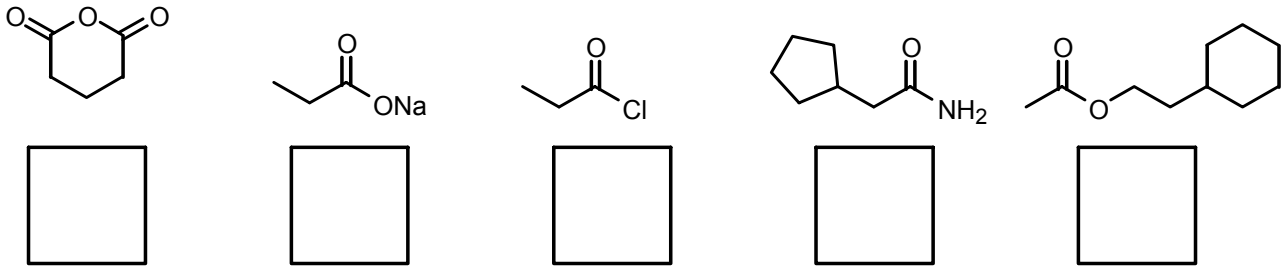
Page	Points
3	4
4	5
5	6
6	4
7	6
8	2
9	9
10	9
11	9
12	9
13	9
14	9
15	7
16	2
17	10
	100

Question 1. (4 points) Miscellaneous.

a. (2 points). Rank the following molecules in order of increasing acidity (which is the same as decreasing pKa). Write a 6 in the box for the least acidic, a 1 in the box under the most acidic, and so on.



b. (2 points). Rank the following molecules in order of increasing reactivity toward nucleophilic attack. Write a 5 in the box under the least reactive, a 1 for the most reactive, and so on.



6 — Atomic number
C — Symbol
12.011 — Atomic mass

PERIODIC TABLE OF THE ELEMENTS

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

Periods	Groups 1A	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB	VIIIB	VIIIB	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
																		2 He 4.00260
	1 H 1.00079												5 B 10.81	6 C 12..011	7 N 14.0067	8 O 15.9994	9 F 18.998403	10 Ne 20.179
	3 Li 6.941	4 Be 9.01218											13 Al 26.98154	14 Si 28.0855	15 P 30.97376	16 S 32.06	17 Cl 35.453	18 Ar 39.948
	11 Na 22.98977	12 Mg 24.305											31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
	19 K 39.0963	20 Ca 40.08	21 Sc 44.9559	22 Ti 47.90	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	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.30
	37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	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	81 Tl 204.37	82 Pb 207.2	83 Bi 208.9804	84 Po (209)	85 At (210)	86 Rn (222)
	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						
	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

†Actinide series

90 Th 232.0381	91 Pa 231.0359	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)

Question 2. (5 points) Nomenclature. Provide a structure for each of the following.

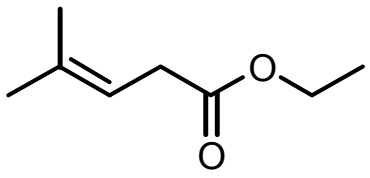
a. 3-ethylhexanoic acid

b. 4-bromo-3-methylpentanoic acid

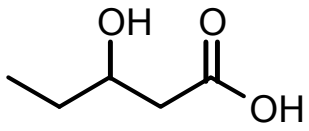
c. propyl ethanoate

Provide a name for each of the following.

d.

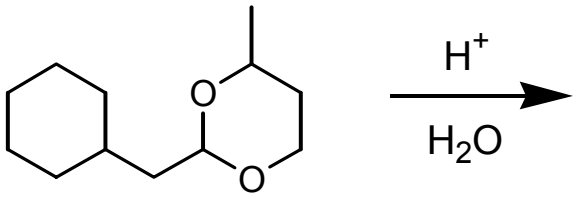


e.

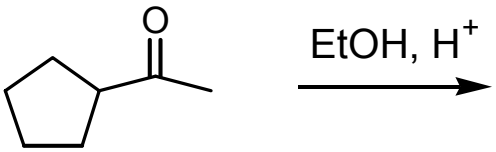


Question 3. (6 points) Acetals and hemi-acetals. Draw all organic product(s) from the following reactions.

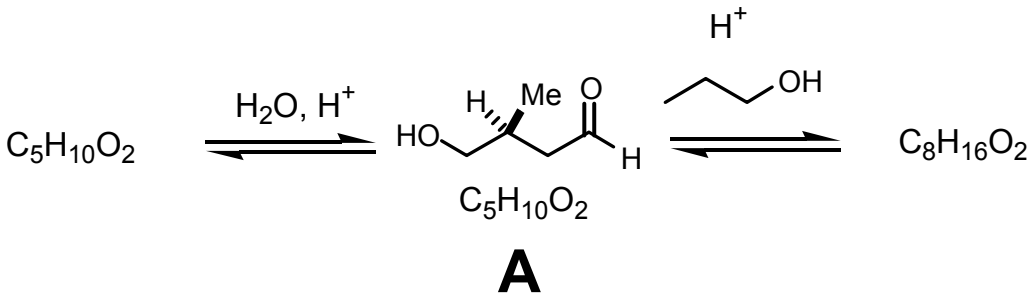
a.



b.

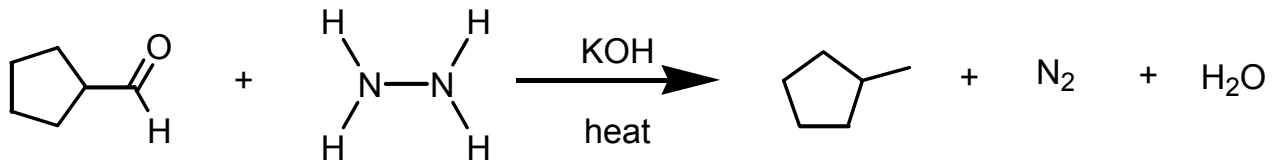


Question 4. (4 points) Acetals and hemi-acetals. Compound **A** is optically active and is a single enantiomer. Draw the structures for the hemi-acetal and the acetal including all possible stereoisomers.

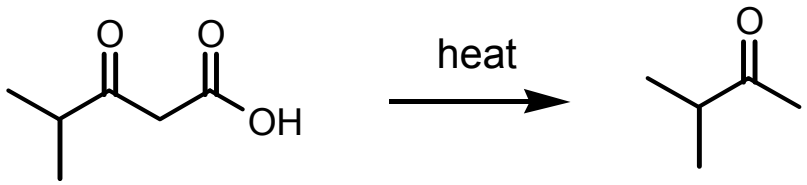


A

Question 5. (6 points) Provide the mechanism for the Wolff-Kishner Reduction shown below.

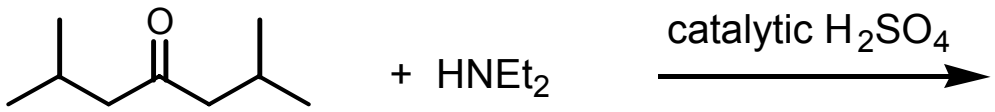


Question 6. (2 points) Provide a detailed mechanism for the following reaction.

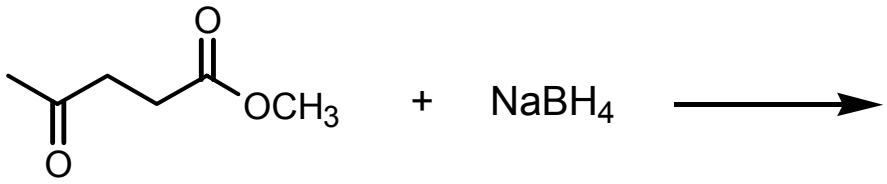


Question 7. (45 points) Show the expected products from the following reactions. You may assume the reaction is finished with a standard workup if needed.

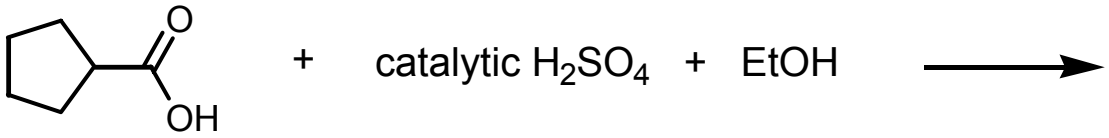
a.



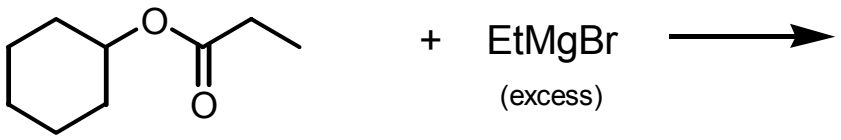
b.



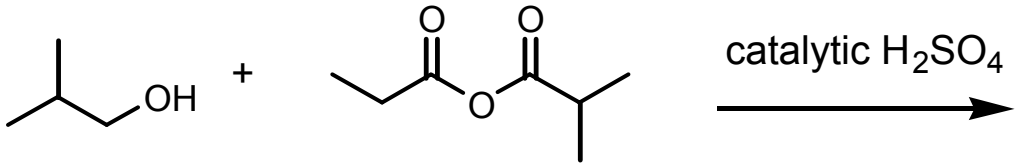
c.



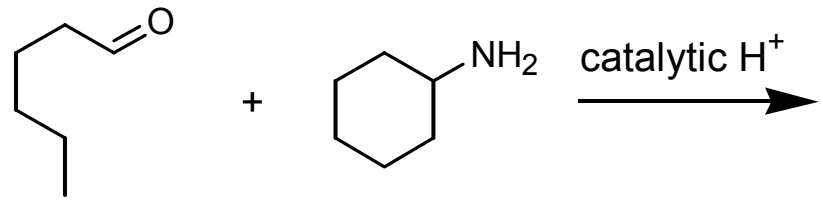
d.



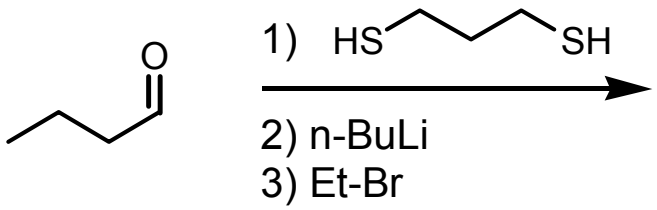
e.



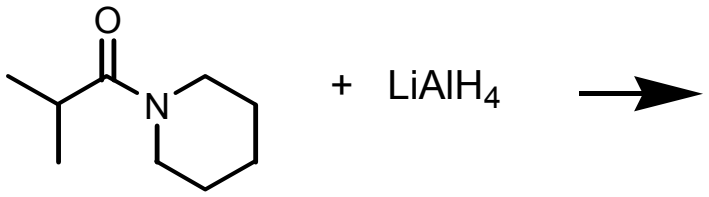
f.



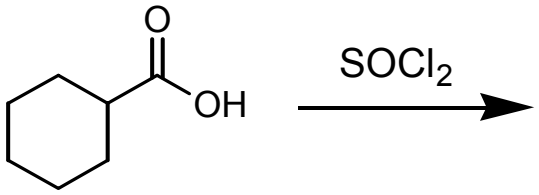
g.



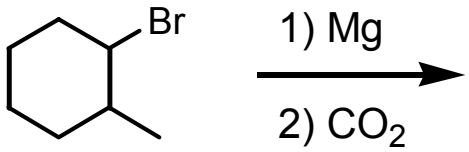
h.



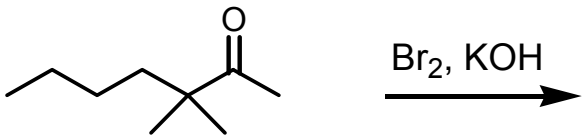
i.



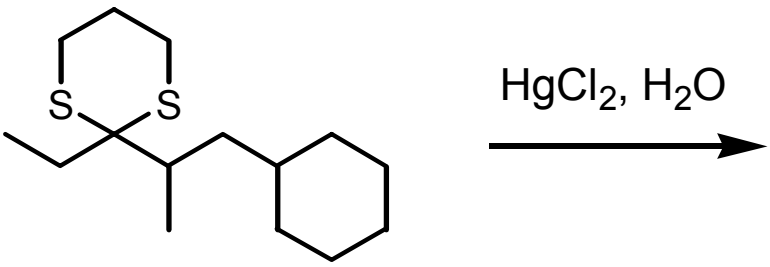
j.



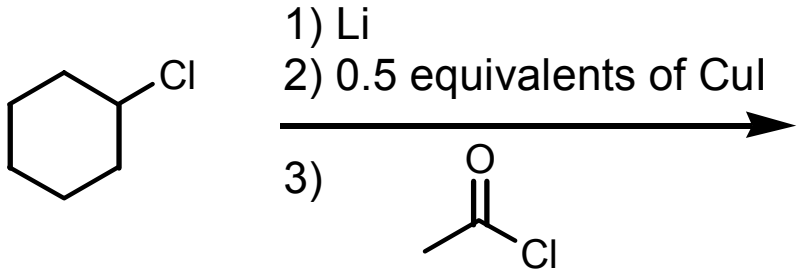
k.



l.

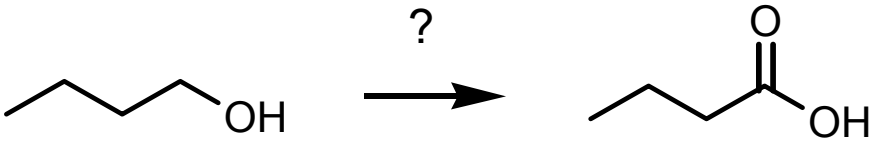


m.

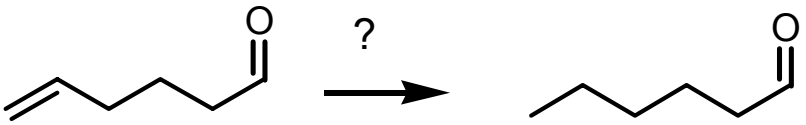


Question 8. (9 points) Provide the necessary reagents to effect the following reactions.

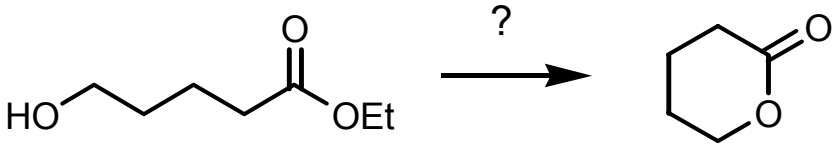
a.



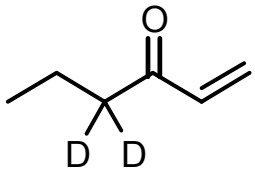
b.



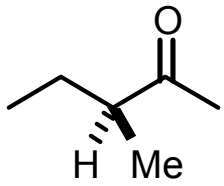
c.



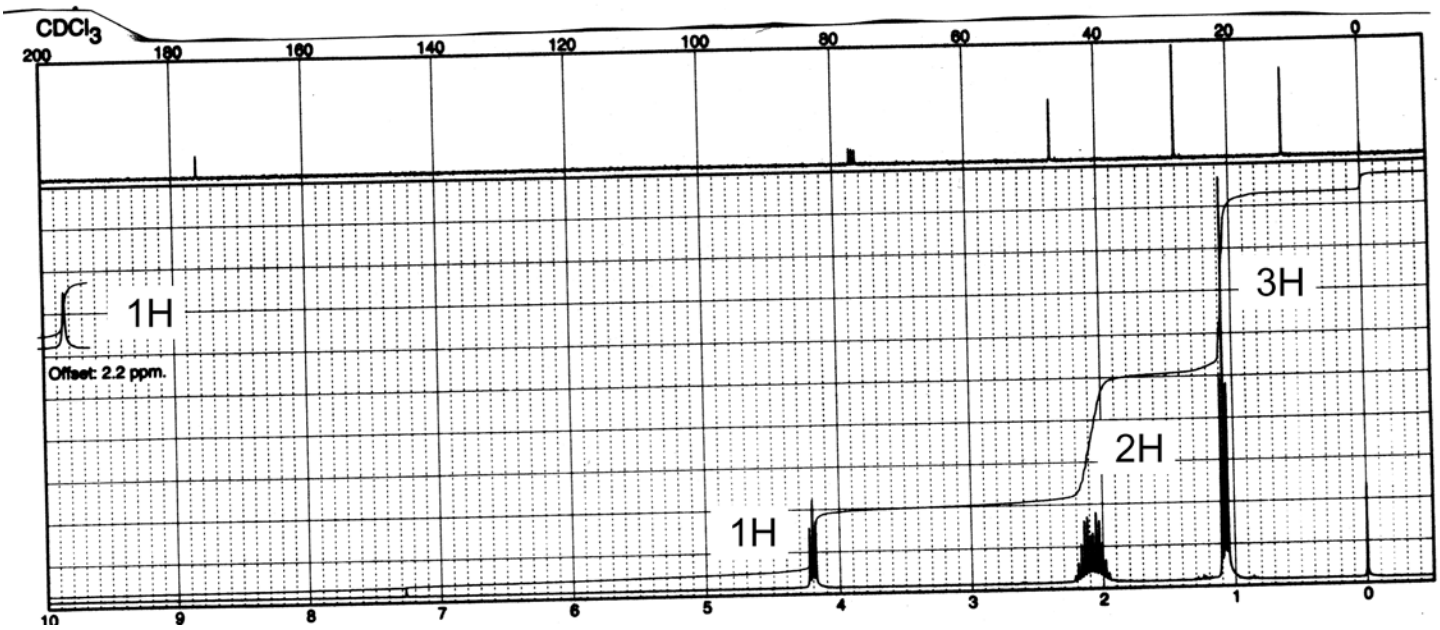
Question 9. (7 points) Propose a synthesis of the following molecule starting from anything with 4 carbons or less. The only sources of deuterium you can use are D_2O and D_2SO_4.

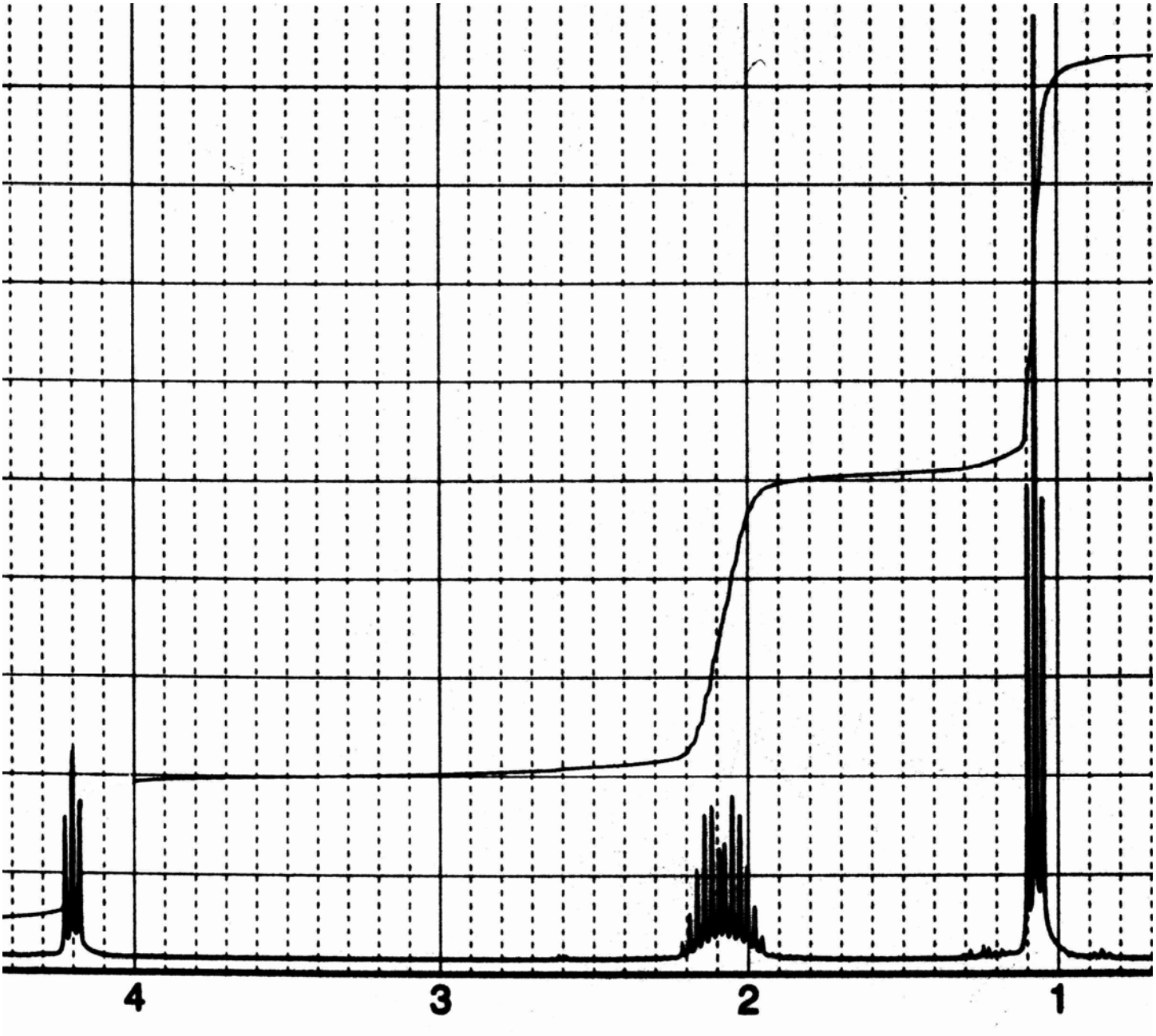


Question 10. (2 points) The ketone shown below is an optically active single enantiomer, but when stored it gradually becomes racemic. Provide a mechanism to show how racemization occurs.



Question 11. (10 points) NMR. Formula $C_4H_7O_2Br$. Enlargement on next page. This compound is readily soluble in basic water, and the IR spectrum shows a very broad peak around 3100 and a strong peak at about 1700 cm^{-1}.

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