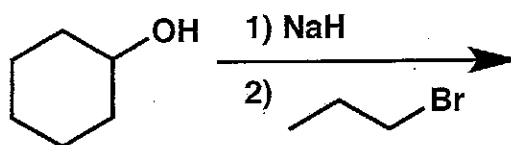


General Instructions:

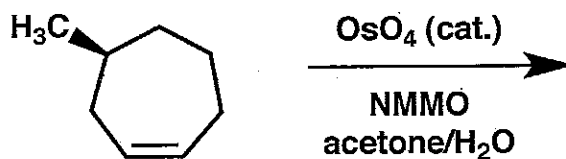
- (i) Use scratch paper at the back of the exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.
- (ii) Print your name on each page.
- (iii) Please keep your paper covered and your eyes on your own work. Misconduct will lead to failure in the course.

1. (21 points) Show the major product(s) expected from the reactions below.

(a)

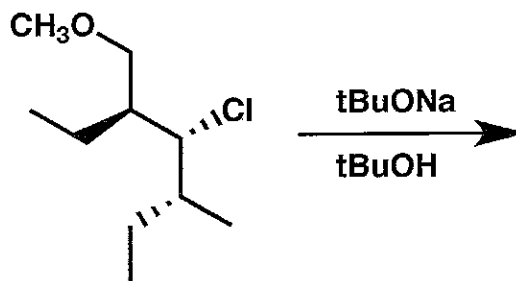


(b)



(Single enantiomer)

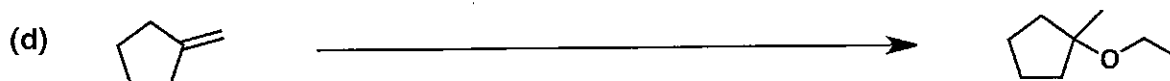
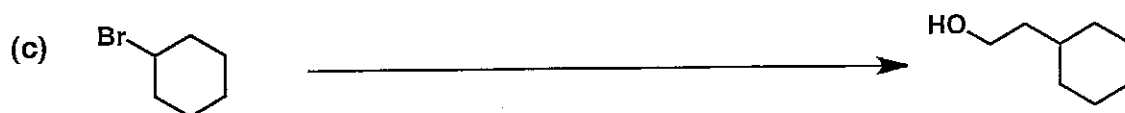
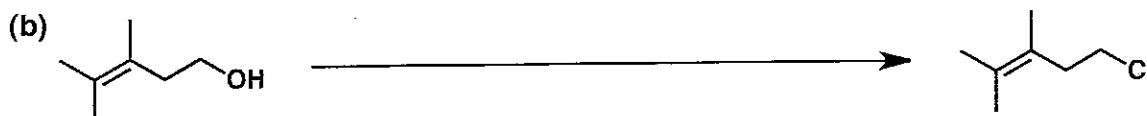
(c)



(Single enantiomer)

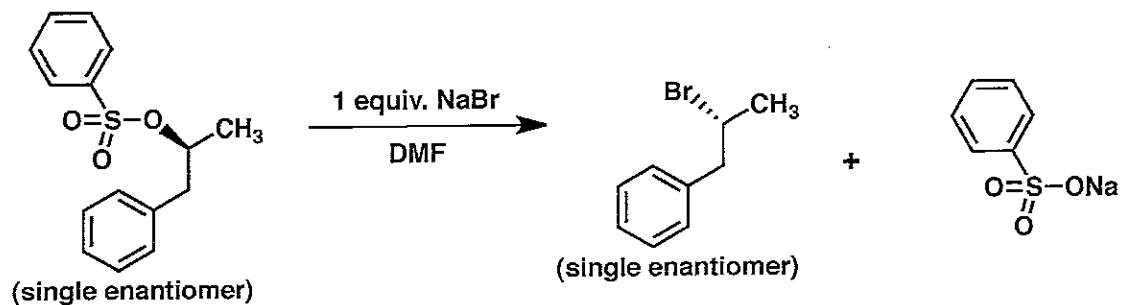
(HINT: There are two isomeric products)

2. (22 points) Show the reagents required to convert the starting molecule to the indicated product. If necessary, be sure to differentiate clearly between distinct steps, by using "1)", "2)", etc. over the arrow.



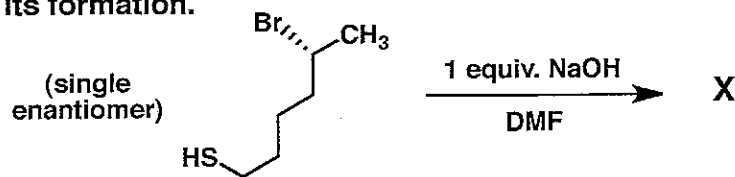
3. (16 points)

(a) Provide a mechanism (curved arrows) for the reaction shown below.



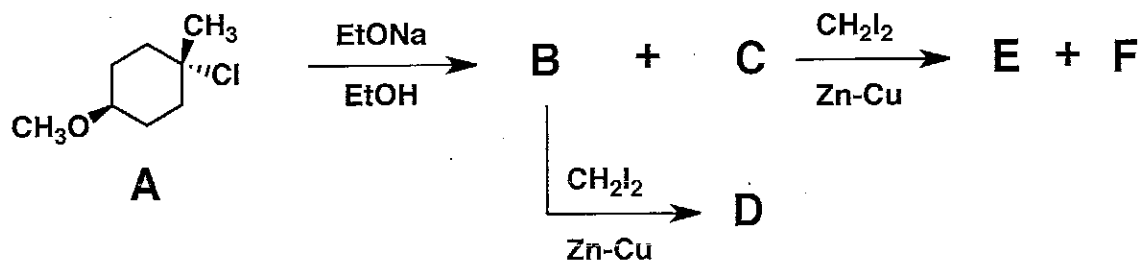
(b) In the reaction above, the organic starting material and NaBr are added in equimolar amounts. If, however, a 10-fold molar excess of NaBr is used, the resulting alkyl bromide is racemic rather than a single enantiomer. Give a mechanism that accounts for this change in the stereochemical outcome.

(c) The reaction below leads to formation of one organic product, X, which does not react further when exposed to H_2 and Pd/C. Show the structure of X and a mechanism to account for its formation.

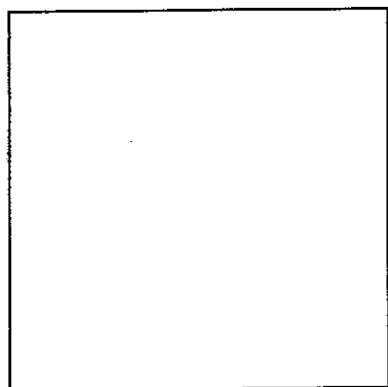


4. (25 points) Treatment of molecule A with sodium ethoxide in ethanol produces two isomeric products, B and C. B is achiral, while C is a racemic mixture. After B and C are separated from one another, each is allowed to react with the reagents shown. B produces a single achiral product, D, while C produces two isomeric products, E and F, each of which is a racemic mixture.

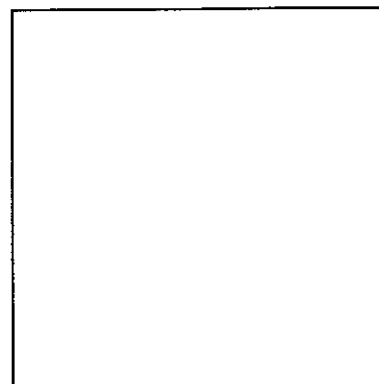
Draw structures for B-F in the boxes. For racemic mixtures, only one enantiomer need be drawn.



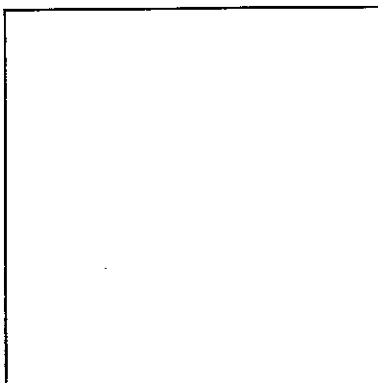
B =



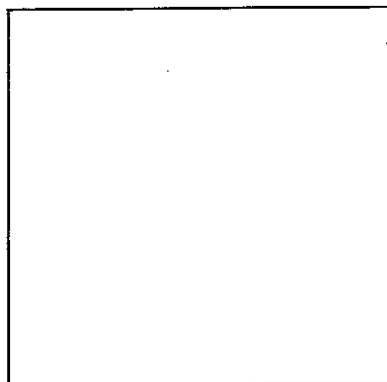
C =



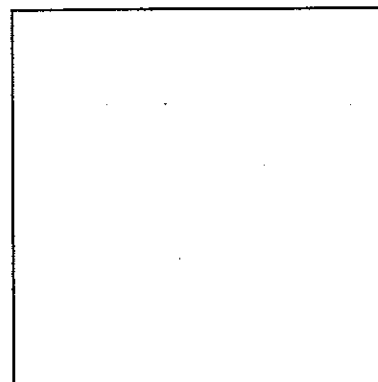
D =



E =

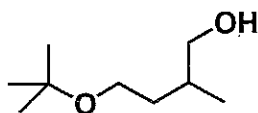


F =

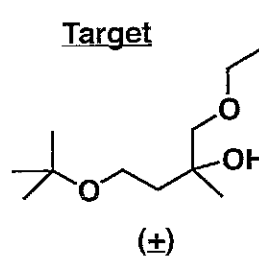


5. (16 points) Suggest a synthetic route (i.e., a specific sequence of reactions) that would be expected to produce the "target" molecule from the indicated starting material. You may use any reagents in your proposed route. Try to reach the target with the fewest possible reactions, and try to choose reactions that are as selective as possible for one target (rather than a mixture of targets).

Starting Material



Target



<u>Problem #</u>	<u>Score</u>
1	/ 21
2	/ 22
3	/ 16
4	/ 25
5	/ 16

Total: / 100

Periodic Table of the Elements

<table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">1 H 1.008</td> </tr> </table>																1 H 1.008	2 He 4.003
1 H 1.008																	
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.011	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 58.71	29 Cu 63.55	30 Zn 65.37	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 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30
55 Cs 132.91	56 Ba 137.34	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.03	89 Ac (227)	104 Unq* (261)	105 Unp* (262)	106 Unh* (263)	107 Uns* (262)	108 Uno* (265)	109 Unh* (266)									

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (249)	98 Cf (249)	99 Es (254)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Lanthanides

Actinides

*Symbol (and name) provisional. Numbers in parentheses: available radioactive isotope of longest half-life.

