Final Exam
Chemistry 343 (PM)
Professor Gellman
21 December 2012

Last Name _____

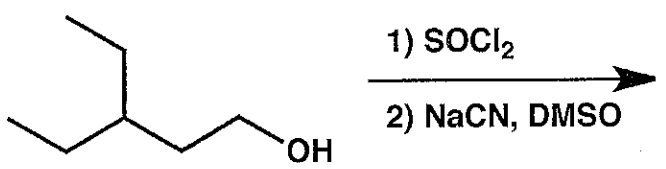
First Name _____

00180

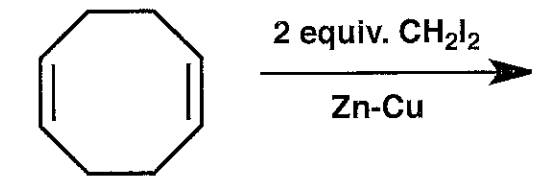
General Instructions:
(i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.
(ii) Print your name on each page.
(iii) Please keep your paper covered and your eyes on your own work. Misconduct will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

1. (40 points) Show the major product or products expected from each reaction.

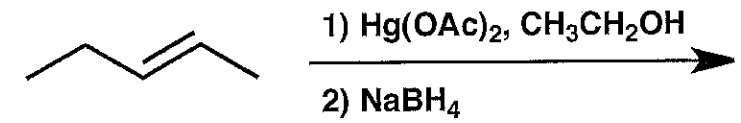
(a)



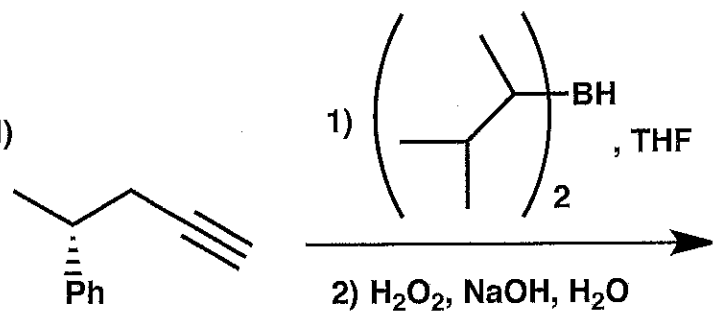
(b)



(c)



(d)



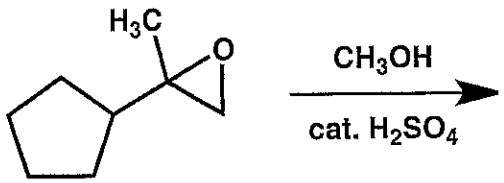
(single enantiomer)

(continued on next page)

Name _____

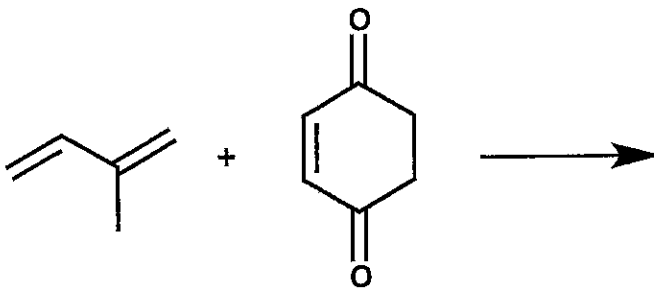
1. (cont.)

(e)

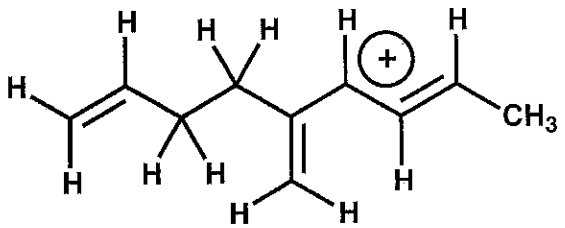


(±)

(f)



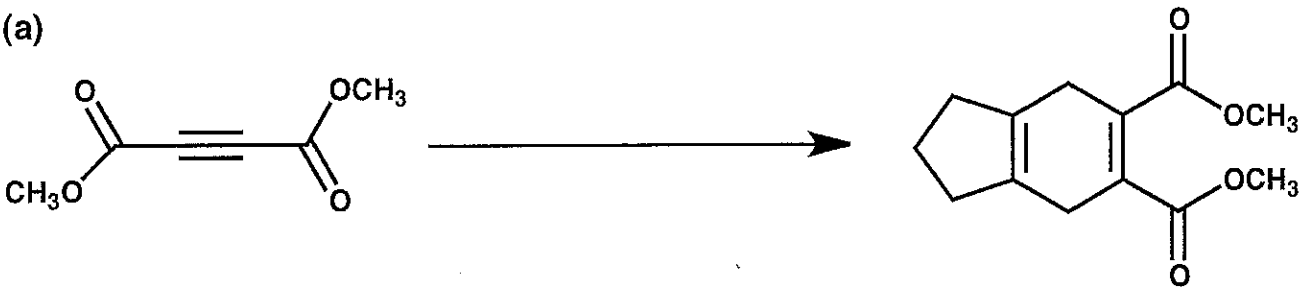
2. (8 points) Draw all of the other resonance structures for the carbocation shown below. Skeletal drawings (no H's) are acceptable, if they are correct.



Name _____

3. (25 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.

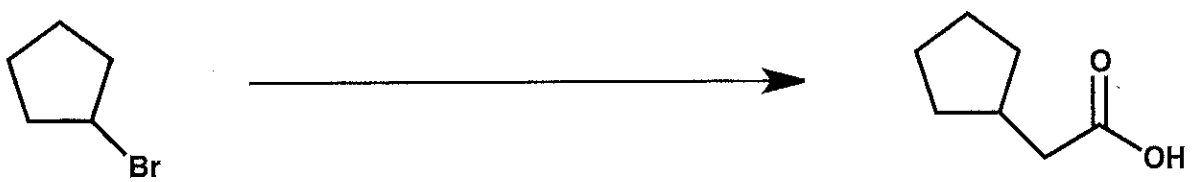
(a)



(b)

(c)

(d)



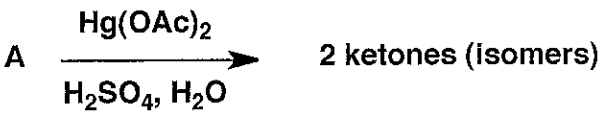
Name _____

4. (16 points) Propose one structure each for molecules A and B (there may be more than one correct answer).

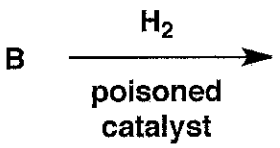
Molecule A has the formula $C_{10}H_{14}$ and is not chiral.

Molecule A reacts with 1 equivalent of H_2 in the presence of a poisoned catalyst, but with 2 equivalents of H_2 in the presence of Pd/C.

A =



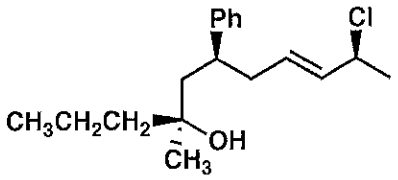
Molecule B has the formula C_7H_7F and is not chiral.



B =

Name _____ 00180

5. (30 points)



G

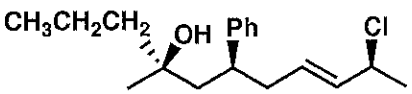
Among the structures drawn below the line, indicate isomeric relationships to the structure of molecule G, drawn above, by following the directions below. Molecule G is a single enantiomer.

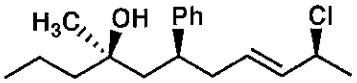
Put a CIRCLE around any structure that corresponds to G (i.e., a different drawing of the same molecule).

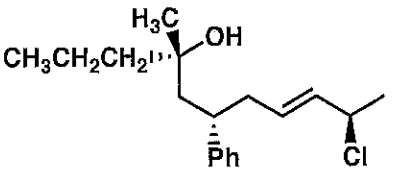
Put a SQUARE around any structure that corresponds to the ENANTIOMER of G.

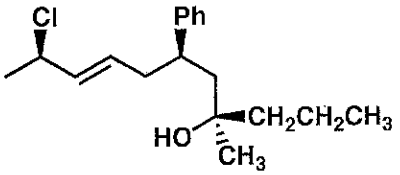
Put a TRIANGLE around any structure that corresponds to a DIASTEREOMER of G.

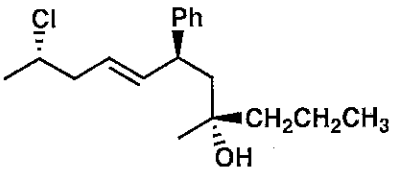
Put an X across any structure that corresponds to a CONSTITUTIONAL ISOMER of G.

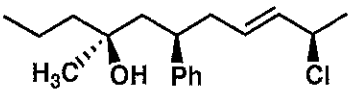




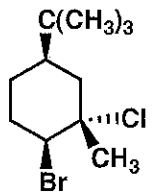








6. (12 points) Provide drawings for the most stable conformation of the molecule shown below (which is a single enantiomer), and for the most stable conformation of the diastereomer that has the opposite configuration at the carbon bearing the bromine atom.



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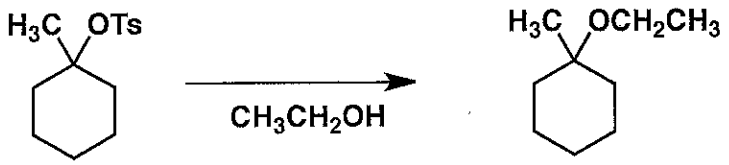
7. (10 points) For each set of reactions shown below, indicate the expected order of reaction rates (fastest vs. intermediate vs. slowest) using the designations A-C or D-F. Note: Do not be concerned about other products that might form during these reactions.

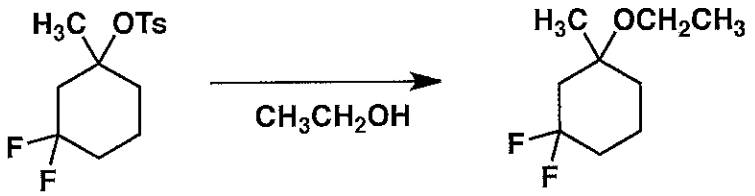
(a) A $NaSCH_3 + CH_3CH_2Br \xrightarrow[CH_3OH]{} NaBr + CH_3CH_2SCH_3$

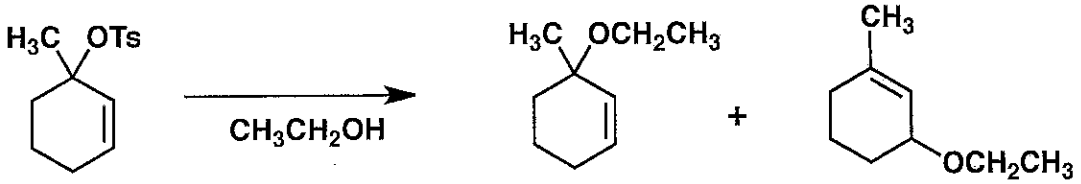
B $NaSCH_3 + CH_3CH_2Br \xrightarrow[DMF]{} NaBr + CH_3CH_2SCH_3$

C $NaSCH_3 + CH_3CHBrCH_3 \xrightarrow[CH_3OH]{} NaBr + CH_3CH_2(SCH_3)CH_3$

Fastest = _____ Intermediate = _____ Slowest = _____

(b) D 

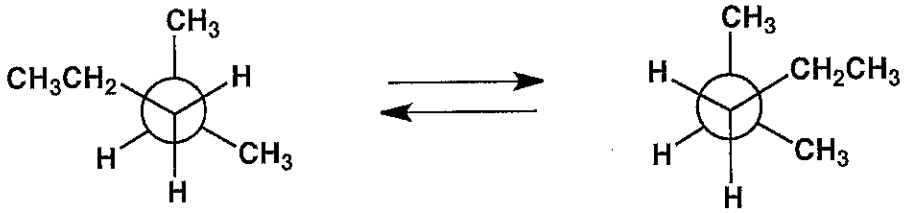
E 

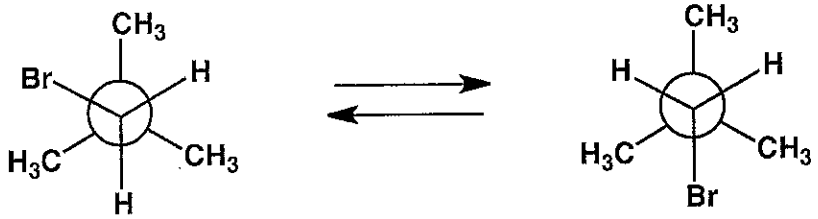
F 

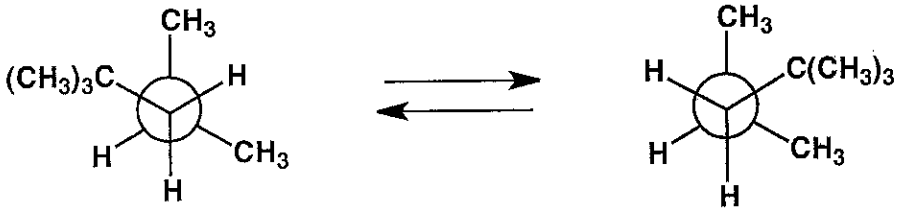
Fastest = _____ Intermediate = _____ Slowest = _____

Name _____ 00180

8. (5 points) For the set of equilibria shown below, indicate the order in propensity to lie to the right (most vs. intermediate vs. least), using the designations A-C.

A 

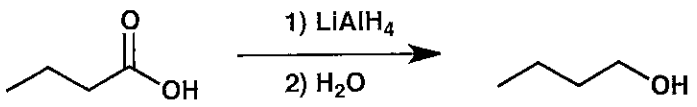
B 

C 

Most = _____ Intermediate = _____ Least = _____

9. (6 points) Using the 'simplified' rules we discussed in class for assigning oxidation states to carbon atoms within molecules, categorize each of the reactions below as "oxidation", "reduction" or "no redox change". These categorizations should be based on the organic molecules to the left and right of the arrow; do not be concerned with any reagents. Also, do not concern yourself with the mechanism of any reaction below, which will be covered in Chemistry 345.

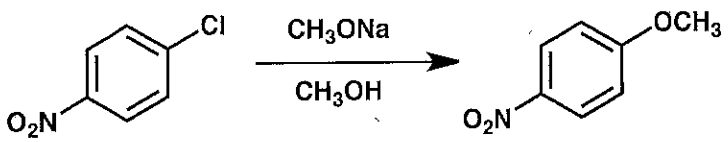
CIRCLE ONE

(a) 

Oxidation

Reduction

No redox change

(b) 

Oxidation

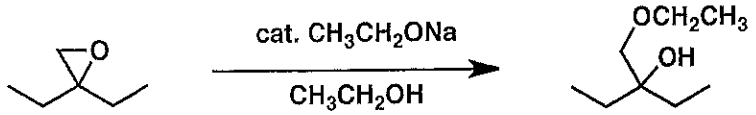
Reduction

No redox change

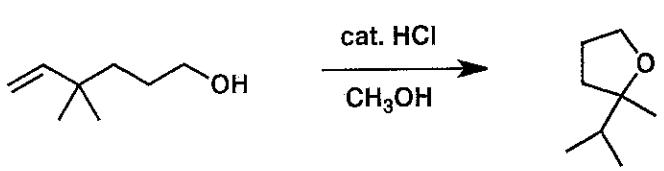
Name _____ 00180

10. (18 points) Provide a mechanism (curved arrows) for each reaction shown below. Be sure to show intermediates.

(a)



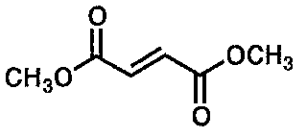
(b)

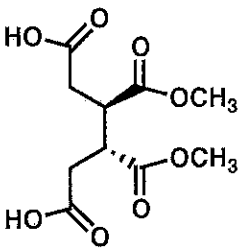


Name _____ 00180

11. (30 points) Devise a synthetic route from the indicated starting material to the indicated target in each of the two cases below. Each route should be as short and as selective as possible. You may use any other organic molecules and any inorganic reagents in your synthetic plans. Show the expected product after each step in each synthetic route. (Do not provide mechanistic information.)

(a)

Starting material = 

Target =  (±)

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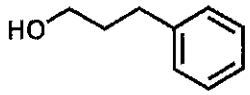
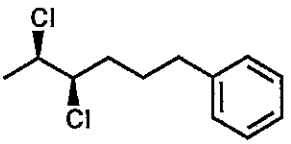
11. (cont.)

Starting material =



Target =



(±)

Name _____ 00180

Problem #	Score
1	/ 40
2	/ 8
3	/ 25
4	/ 16
5	/ 30
6	/ 12
7	/ 10
8	/ 5
9	/ 6
10	/ 18
11	/ 30

_____

Total: / 200

00180

Periodic Table of the Elements

																	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 Una* (266)									

Lanthanides	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
Actinides	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)

*Symbol (and name) provisional.

Numbers in parentheses: available radioactive isotope of longest half-life.