

CHEM 3311 (Richardson) Second Hour Exam – March 10, 2015

Your Name Key

Student ID _____

Recitation Time 12:00 Monday, 1:00 Monday,
11:00 Tuesday, 1:00 Tuesday,
12:00 Wednesday

Question	Score	Out of
1		15
2		10
3		25
4		30
5		10
6		10
7		6 ec
Total		100

This is a closed-book exam. The use of notes, calculators, or cell phones will not be allowed during the exam. You may use models sets brought in a clear ziplock bag. Use the backs of the pages for scratch work. If your final answer is not clearly specified, you will lose points. For mechanisms, show all intermediates including correct formal charges, but do not show transition states.

1																2																					
H																He																					
3		4														5		6		7		8		9		10											
Li		Be														B		C		N		O		F		Ne											
11		12														13		14		15		16		17		18											
Na		Mg														Al		Si		P		S		Cl		Ar											
19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36			
K		Ca		Sc		Ti		V		Cr		Mn		Fe		Co		Ni		Cu		Zn		Ga		Ge		As		Se		Br		Kr			
37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54			
Rb		Sr		Y		Zr		Nb		Mo		Tc		Ru		Rh		Pd		Ag		Cd		In		Sn		Sb		Te		I		Xe			
55		56		57-70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86	
Cs		Ba		*		Lu		Hf		Ta		W		Re		Os		Ir		Pt		Au		Hg		Tl		Pb		Bi		Po		At		Rn	
87		88		89-102		103		104		105		106		107		108		109		110		111		112		113		114		115		116		117		118	
Fr		Ra		**		Lr		Rf		Db		Sg		Bh		Hs		Mt		Uun		Uuu		Uub		Uuq		Uur		Uus		Uut		Uuq		Uuq	

* Lanthanide series

57	58	59	60	61	62	63	64	65	66	67	68	69	70
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb

** Actinide series

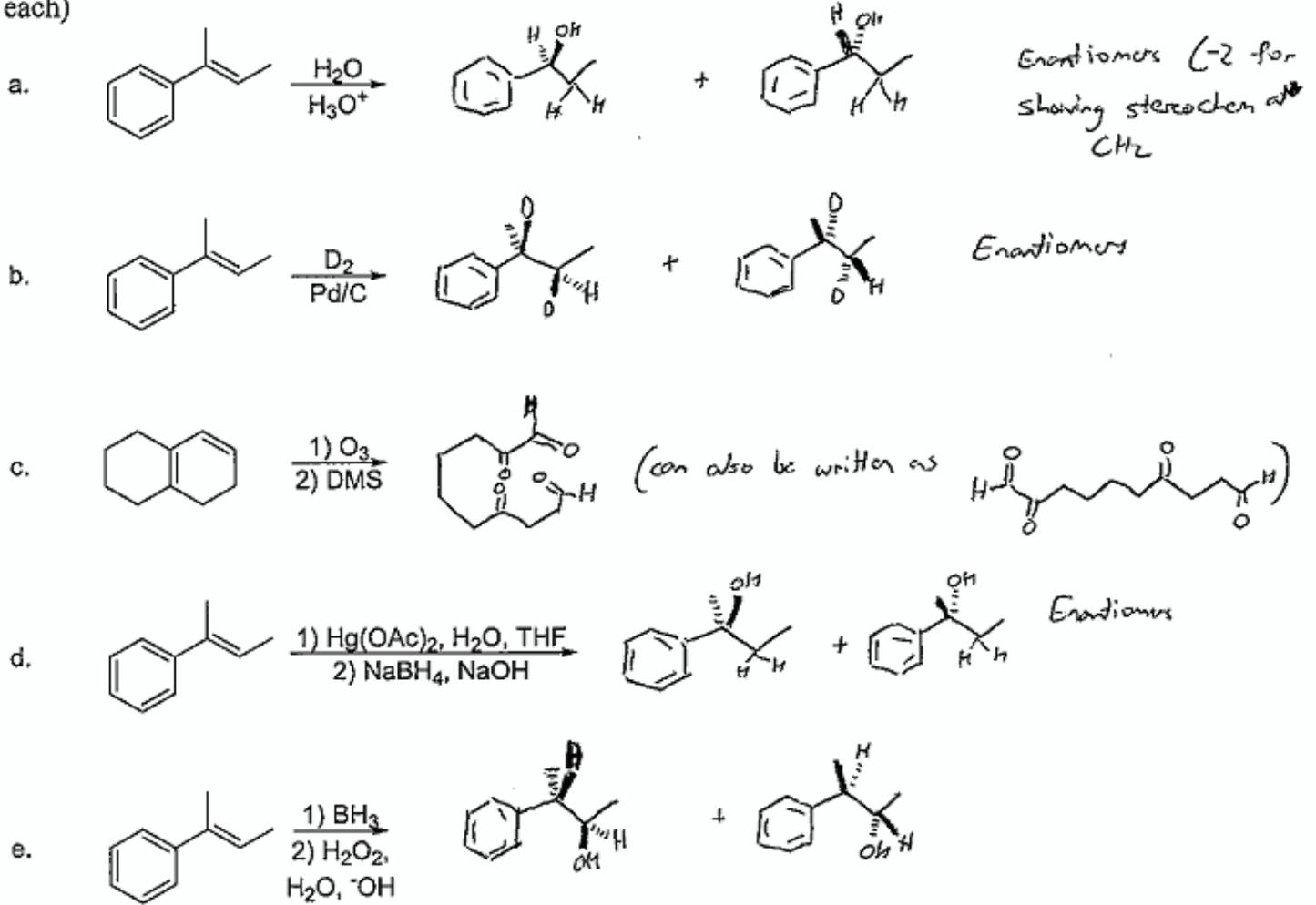
88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Average = 81.6
St. Dev = 16.8
Max = 106
Min = 29.5

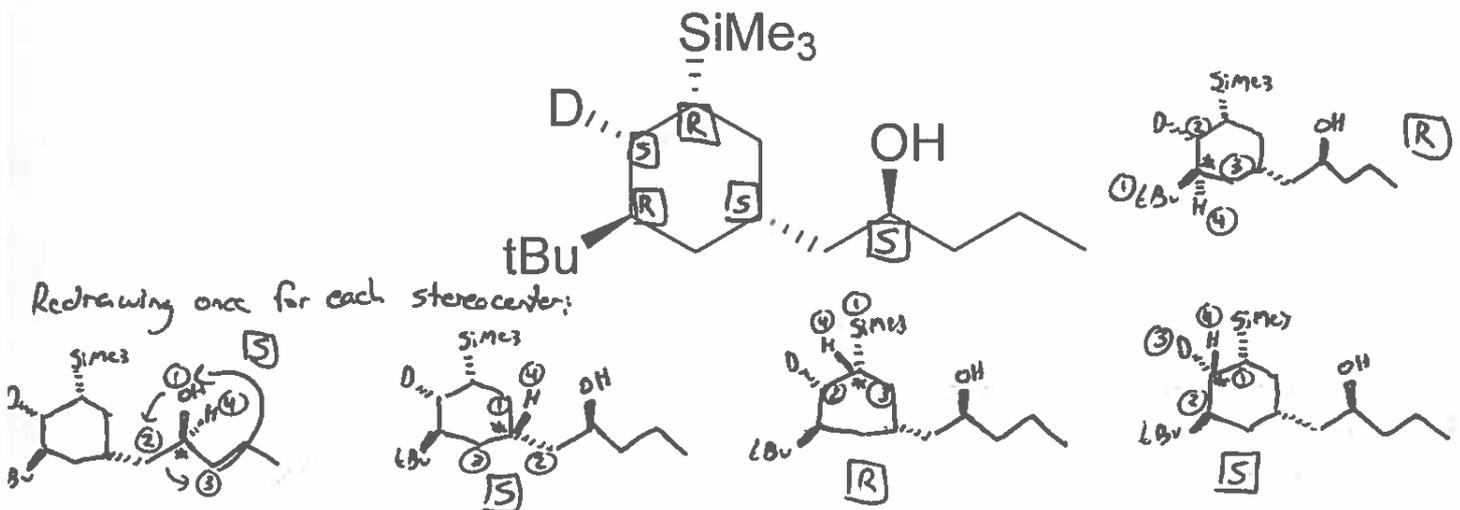
pKa Values

HI	-10	CH ₃ COOH	4.7	Phenol	10	H ₂	35
HBr	-8	HN ₃	4.7	RSH	10-12	NH ₃	36
HCl	-6	H ₂ S	7.0	H ₂ O	15.7	H ₂ C=CH ₂	45
H ₃ O ⁺	-1.7	NH ₄ ⁺	9.3	Alcohol (ROH)	16-18	CH ₄	60
HF	3.2	HCN	9.4	HC≡CH	26		

1) For each reaction shown below, predict the product(s). If a mixture of stereoisomers is formed, show all stereoisomers using wedges and dashes to indicate configuration, and specify whether they are enantiomers or diastereomers. If more than two products are created, you should specify the relationship between each pair of products. (15 pts - 3 pts each)

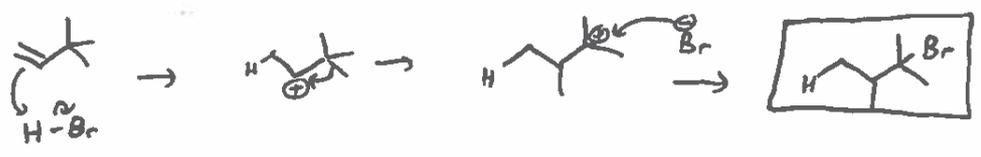


2) In the structure shown below, label each stereocenter as R or S. (10 pts)



3) Addition mechanisms: For radical reactions, clearly label the initiation, propagation, and termination steps, and show at least two examples of termination. (25 pts)

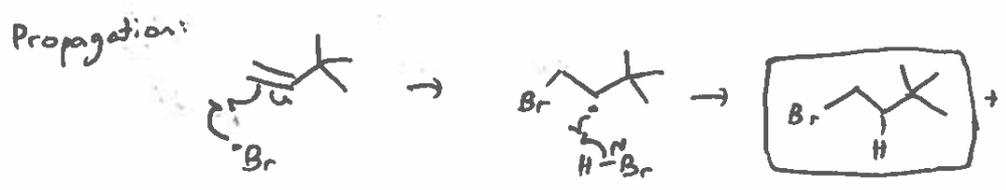
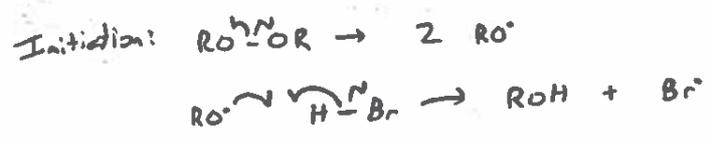
a. Show the mechanism for this reaction, and draw a box around the major product. (10 pts)



4 pts for boxed correct product
2 pts per step

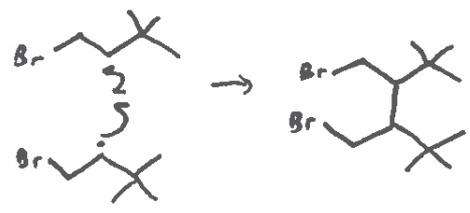
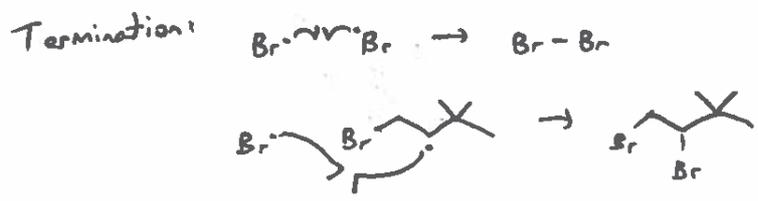
E (-4 for no C+ rearrangement)

b. Show the mechanism for this reaction, and draw a box around the major product. (15 pts)



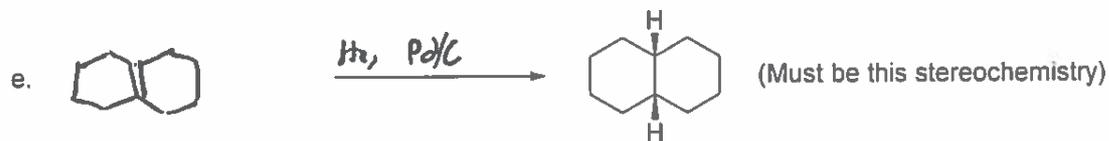
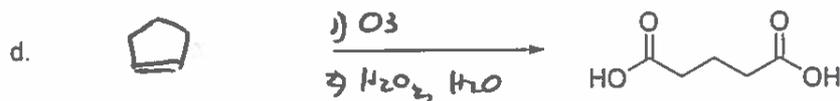
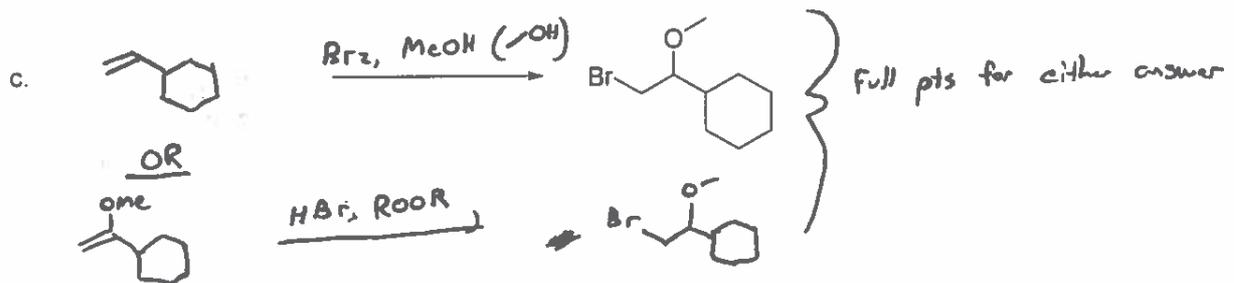
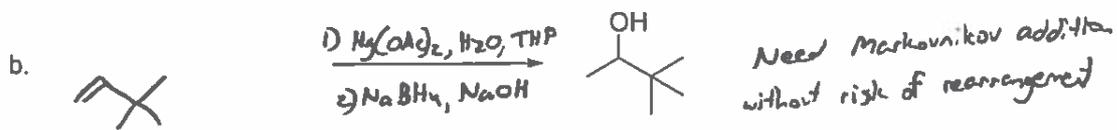
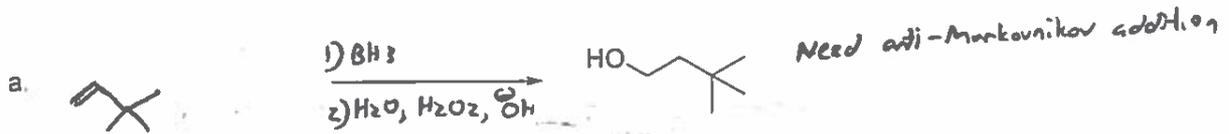
3 pts for boxed, correct product

4 pts for each group of steps

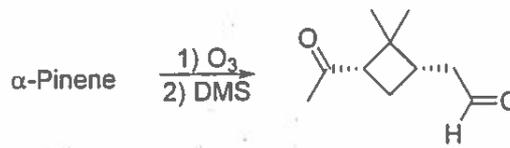
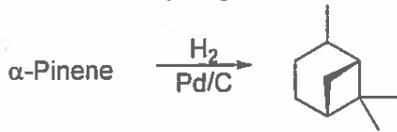


(-2 for regular errors instead of fishhook arrows)

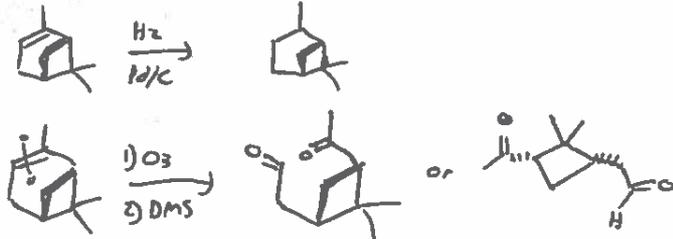
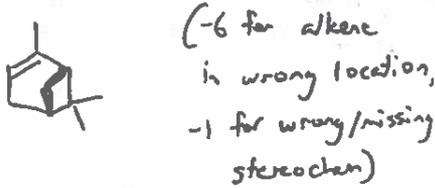
- 4) Using any reactions that have been covered so far in class, show how you would create the products shown, starting with any alkene that has the same number of carbon atoms as the product. Write your starting material before the arrow, and the other reagents above or below the arrow. (30 pts - 6 pts each).



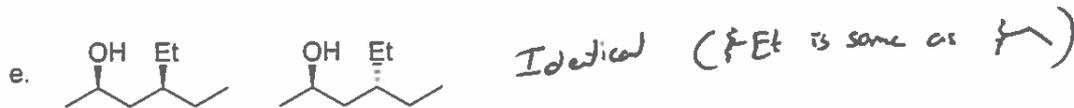
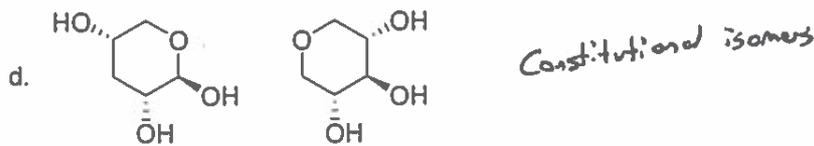
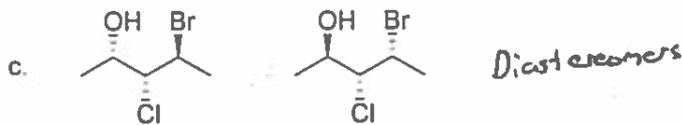
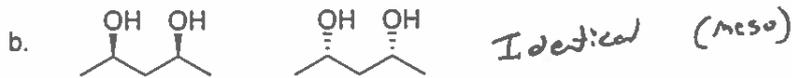
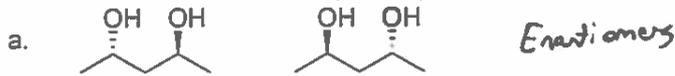
- 5) In your lab, you have found a mysterious bottle labeled "α-Pinene." In an attempt to discover its structure, you perform some reactions on it and observe the following results.



What is the structure of α-pinene? (10 pts)



- 6) For each of the following pairs of molecules, are they identical, enantiomers, diastereomers, or constitutional isomers? (10 pts - 2 pts each)



- 7) Extra credit! Show the monomer that would be used to form each of these polymers. (6 pts extra credit - 3 pts each)

