

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

Your Name _____

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.

hydrogen 1 H 1.0079																		helium 2 He 4.0026	
lithium 3 Li 6.941	beryllium 4 Be 9.0122																		neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305																		argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80		
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	silver 46 Ag 106.42	cadmium 47 Cd 107.87	indium 48 In 112.41	tin 49 Sn 114.82	antimony 50 Sb 118.71	tellurium 51 Te 121.76	lead 52 Pb 127.60	thallium 53 Tl 128.41	mercury 54 Hg 129.6	gold 55 Au 127.60	
cesium 55 Cs 132.91	barium 56 Ba 137.33	* 57-70 Lu	* 71 Lu	* 72 Lu	* 73 Lu	* 74 Lu	* 75 Lu	* 76 Lu	* 77 Lu	* 78 Lu	* 79 Lu	* 80 Lu	* 81 Lu	* 82 Lu	* 83 Lu	* 84 Lu	* 85 Lu	* 86 Lu	
francium 87 Fr [223]	radium 88 Ra [226]	* 89-102 Lr	* 103 Lr	* 104 Lr	* 105 Lr	* 106 Lr	* 107 Lr	* 108 Lr	* 109 Lr	* 110 Lr	* 111 Lr	* 112 Lr	* 113 Lr	* 114 Lr	* 115 Lr	* 116 Lr	* 117 Lr	* 118 Lr	

* Lanthanide series

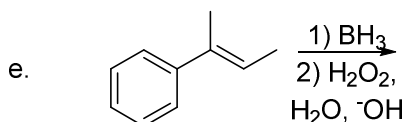
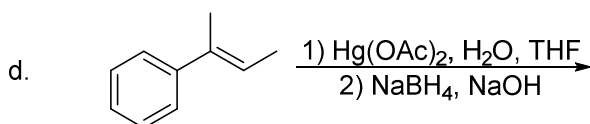
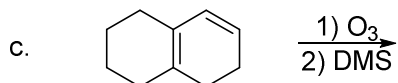
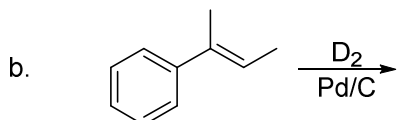
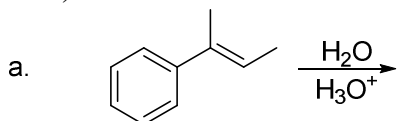
lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

** Actinide series

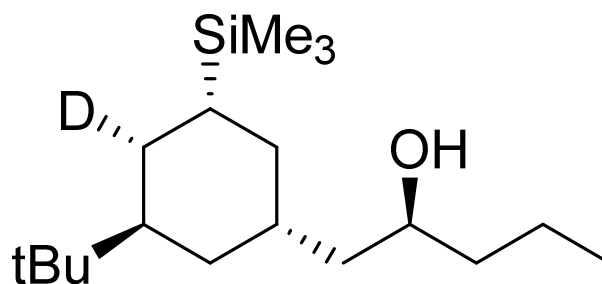
pKa Values

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)

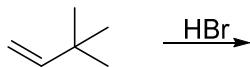


- 2) In the structure shown below, label each stereocenter as R or S. (10 pts)

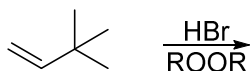


3) Addition mechanisms: For radical reactions, clearly label the initiation, propagation, and termination steps, and show at least two examples of termination. (25 pts)

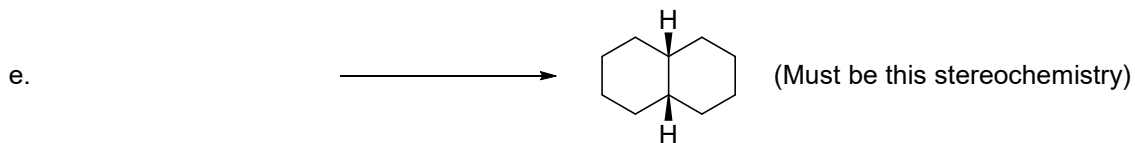
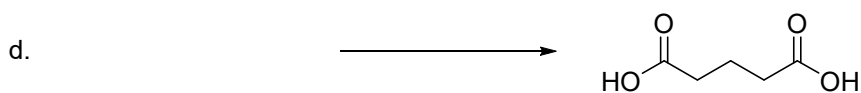
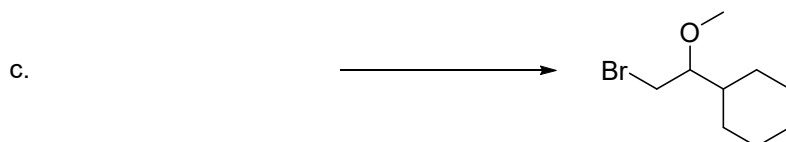
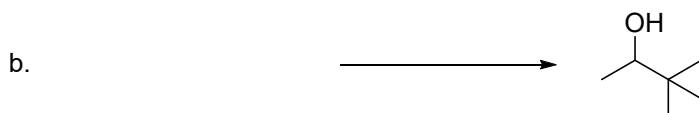
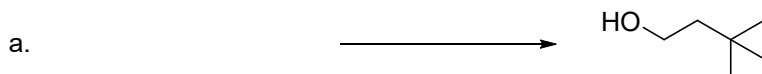
a. Show the mechanism for this reaction, and draw a box around the major product. (10 pts)



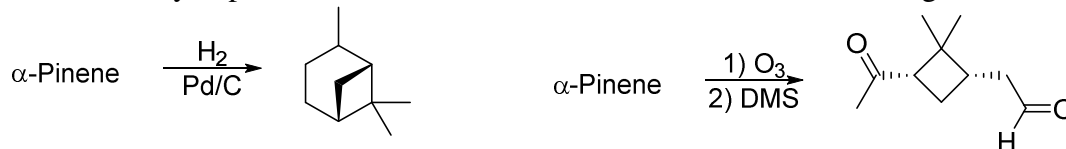
b. Show the mechanism for this reaction, and draw a box around the major product. (15 pts)



- 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).

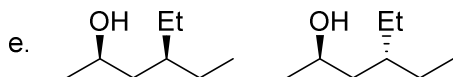
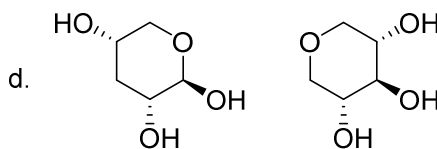
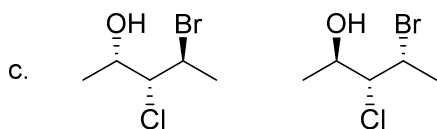
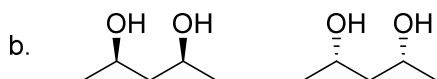
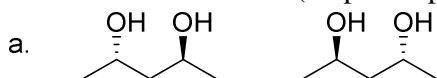


- 5) In your lab, you have found a mysterious bottle labeled “ α -Pinene.” In an attempt to discover its structure, you perform some reactions on it and observe the following results.



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)

