

# CHEM 3311 (Richardson) Third Hour Exam – April 18, 2017

Your Name \_\_\_\_\_

Student ID \_\_\_\_\_

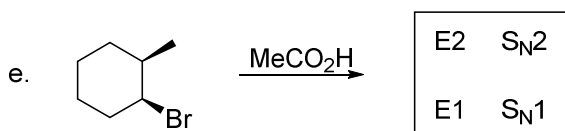
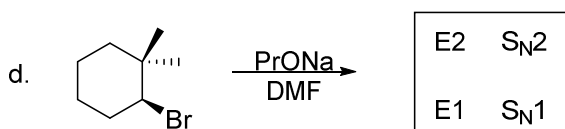
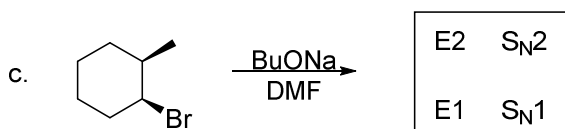
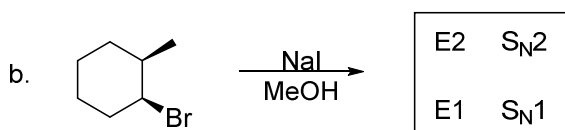
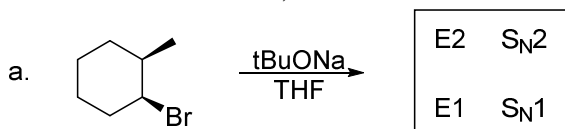
- Recitation Time
- 8:00 Wednesday w/ Josh Kamps
  - 2:00 Wednesday w/ Josh Kamps
  - 10:00 Thursday w/ Brendan Griffiths
  - 11:00 Thursday w/ Brendan Griffiths
  - 12:00 Friday w/ Brendan Griffiths

Question	Score	Out of
1		15
2		15
3		9
4		16
5		25
6		20
7		10 e.c.
<b>Total</b>		<b>100</b>

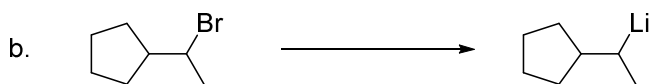
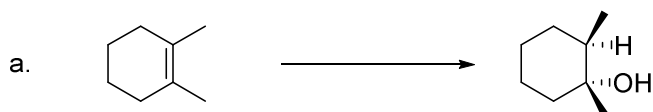
This is a closed-book exam. The use of notes, calculators, or cell phones will not be allowed during the exam. You may use models sets brought in a clear ziplock bag. Use the backs of the pages for scratch work. If your final answer is not clearly specified, you will lose points. For mechanisms, show 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																		boron 5 B 10.811
sodium 11 Na 22.990	magnesium 12 Mg 24.305																		carbon 6 C 12.011
potassium 19 K 39.098	calcium 20 Ca 40.078																		nitrogen 7 N 14.007
rubidium 37 Rb 85.468	strontium 38 Sr 87.62																		oxygen 8 O 15.999
cesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *																	fluorine 9 F 18.998
francium 87 Fr [223]	radium 88 Ra [226]	89-102 * *																	neon 10 Ne 20.180
																			aluminum 13 Al 26.982
																			silicon 14 Si 28.086
																			phosphorus 15 P 30.974
																			sulfur 16 S 32.065
																			chlorine 17 Cl 35.453
																			argon 18 Ar 39.948
																			gallium 31 Ga 69.723
																			germanium 32 Ge 72.61
																			arsenic 33 As 74.922
																			cadmium 48 Cd 112.41
																			indium 49 In 114.82
																			tin 50 Sn 118.71
																			antimony 51 Sb 121.76
																			tellurium 52 Te 127.60
																			lead 82 Pb 208.28
																			bismuth 83 Bi [209]
																			polonium 84 Po [210]
																			astatine 85 At [210]
																			thallium 81 Tl 204.38
																			mercury 80 Hg 200.59
																			gold 79 Au 196.97
																			platinum 78 Pt 195.08
																			iridium 77 Ir 192.22
																			osmium 76 Os 190.23
																			rhodium 45 Rh 101.07
																			nickel 28 Ni 58.693
																			silver 47 Ag 107.87
																			palladium 46 Pd 106.42
																			cobalt 27 Co 58.933
																			iron 26 Fe 55.845
																			technetium 43 Tc [98]
																			niobium 41 Nb 92.906
																			zinc 30 Zn 65.39
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- 1) For each of the reactions shown below, **circle the mechanism(s)** you would expect to see, if any, and **draw the product(s)**. If a product has stereocenters, show its configuration using wedges and dashes. If two stereoisomers are formed, show both of them. If an elimination occurs, show only the major alkene product. If none of the mechanisms would take place in a reasonable time frame, write NR for No Reaction. (15 pts)



- 2) Each of these reactions can be done in a single-step synthesis. On each arrow, show the reagents needed to accomplish each one. In each case, the target product should be the only major product of the reaction. (15 pts)



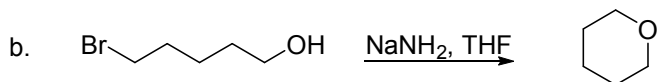
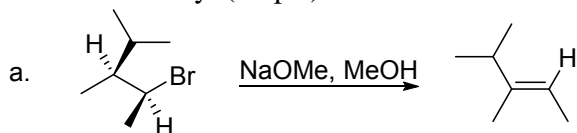
3) For each of the following groups of molecules, circle the one with the highest boiling point and explain why it is higher in under ten words. (9 pts)

a. 1,6-hexanediol; 1,4-dimethoxybutane; 3-propoxy-1-propanol

b. cyclohexane; dioxane; benzene

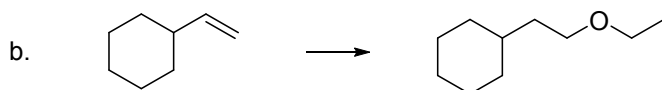
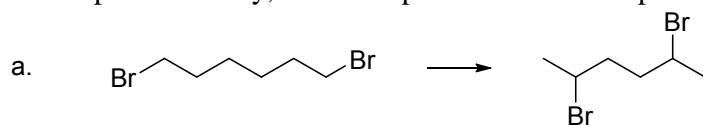
c. 2,5-dimethylhexane; octane; 2,2,3,3-tetramethylbutane

4) Show a reasonable arrow-pushing mechanism for these reactions, including stereochemistry where necessary. (16 pts)



- 5) Inositol, or 1,2,3,4,5,6-cyclohexanehexol, is a chemical compound with formula  $C_6H_{12}O_6$ . Inositol has nine different possible stereoisomers. One specific stereoisomer of inositol, *myo*-inositol, is a sugar alcohol that serves several important biological purposes and is also commonly used as a stand-in for cocaine in movies. Its IUPAC name is *cis*-1,2,3,5-*trans*-4,6-cyclohexanehexol (this indicates that the OH groups on carbons 1,2,3, & 5 are all on the same face of the ring as each other, and the OH groups on carbons 4 & 6 are on the other face). Answer these questions about the molecule. (25 pts total)
- Draw the top-down view of *myo*-inositol, using wedges and dashes to show stereochemistry. (5 pts)
  - Draw both chair conformations of *myo*-inositol and circle the more stable one. (12 pts)
  - myo*-Inositol is very soluble in water for an organic molecule. What intermolecular force is responsible for this property? (3 pts)
  - Draw the top-down view of any five other distinct stereoisomers of inositol. Do not show any duplicate structures. (5 pts)

- 6) Find a way to synthesize the desired product from the given starting material. If more than one step is necessary, show the product of each step. Do not show mechanisms. (20 pts)



- 7) Extra credit! Draw the mechanism for the reaction of 3-methyl-1-butene with HBr (showing the major product only), and identify the HOMO and LUMO of each step. (10 pts e.c.)