

CHEM 3311 (Luca) Final Exam – May 7th 2018

Your Name: _____

Student ID: _____

Recitation (Check one):

- Monday 8am - Mori
- Monday 9am - Carey
- Monday 10am - Carey
- Monday 11am - Carey
- Tue 8am - Park
- Tue 11am - Carey
- Tue 2pm - Carey

Question	Points
1	
2	
3	
4	
5	
6	
Total	

This is a closed-book exam. The use of notes and cell phones will not be allowed during the exam. You may use models sets totally dismantled brought in a clear quart-sized ziplock bag. Use the backs of the pages for scratch work. If your final answer is not clearly specified in the given space, points will not be awarded.

Standard periodic table showing elements from Hydrogen (1) to Oganesson (118). The table includes the Lanthanide and Actinide series at the bottom.

* 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
138.91	140.12	140.91	144.24	144.91	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.04

** Actinide series

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
227	232.04	231.04	238.03	237.05	244	243	247	247	251	252	257	288	289

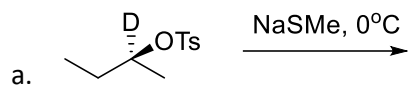
pKa Values

HI	-10	CH ₃ COOH	4.7	ArOH	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	ROH (R=alkyl)	16-18	CH ₄	60
HF	3.2	HCN	9.4	HC≡CH	26		

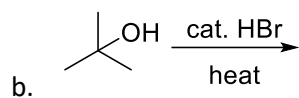
Name _____

1. (50 points)

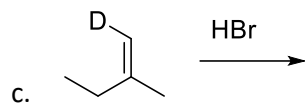
Predict the major product for the following reactions. Show stereochemistry where applicable. For each reaction, list if it is an oxidation, a reduction, or neither (10 points each):



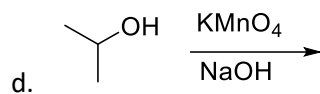
Circle One: Oxidation Reduction Neither



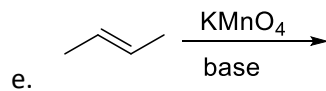
Circle One: Oxidation Reduction Neither



Circle One: Oxidation Reduction Neither



Circle One: Oxidation Reduction Neither

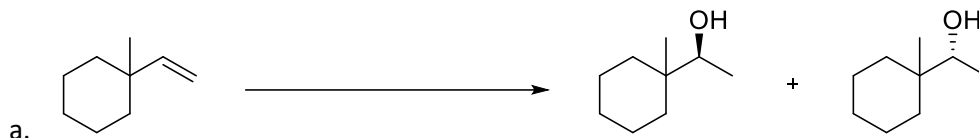


Circle One: Oxidation Reduction Neither

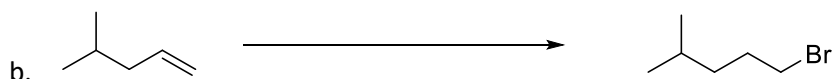
Name _____

2. (50 points)

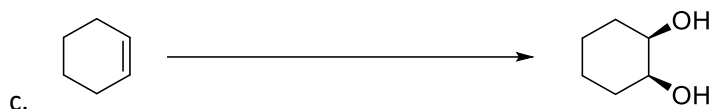
For each of the following reactions, provide the appropriate reagents. Note that these may require more than one step. For each reaction, list if it is an oxidation, a reduction, or neither (10 points each):



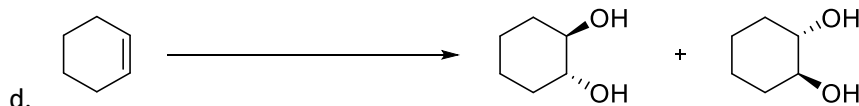
Circle One: Oxidation Reduction Neither



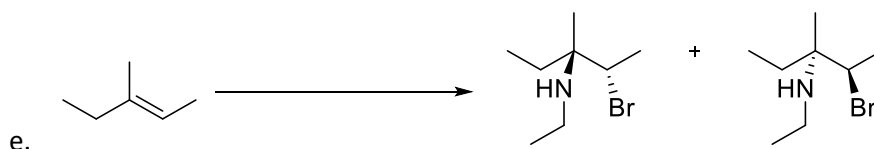
Circle One: Oxidation Reduction Neither



Circle One: Oxidation Reduction Neither



Circle One: Oxidation Reduction Neither



Circle One: Oxidation Reduction Neither

Name _____

3. (50 points)

Compound A, with a molecular formula of C_7H_{14} , reacts with Br_2 in CH_2Cl_2 . Compound A also reacts with BH_3 in THF followed by H_2O_2 / HO^- to yield compound B as a mixture of two enantiomers. When treated with $KMnO_4$ then H_3O^+ , B is oxidized to a carboxylic acid C, also as a mixture of two enantiomers. Compound A, after ozonolysis and workup with H_2O_2 , H_2O , and hydroxide, yields compound D. Compound D is the same compound that is formed when 3-hexanol is oxidized with potassium dichromate. Propose structures for A, B, C, and D. Show **all of your work** including each reaction **with structures** to receive full credit.

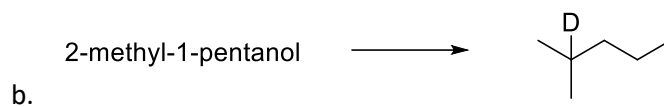
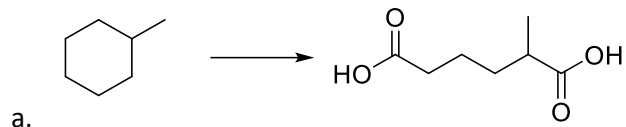
Name _____

- c. Draw out the Lewis structure of the leaving group for the above reaction. Clearly show all lone pairs, formal charges, and provide any significant resonance contributors. Explain why this leaving group is a good leaving group in terms of its stability (hint: consider factors that stabilize bases):
- d. Explain whether or not changing the stereochemistry of the starting material would result in a different product. Draw the reaction as part of your argument:

Name _____

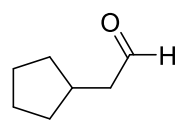
5. (100 points)

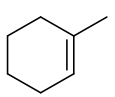
Complete the following syntheses (anything chiral can be synthesized as a racemic mixture). If more than one step is necessary, show the product of each step. Do not show the mechanisms:

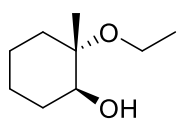
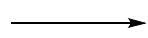


Name _____

c. cyclopentylethylene



d. 



+ enantiomer

Name _____

6. (50 points)

For each of these problems, draw a reasonable reaction mechanism using electron arrow pushing. Clearly show all lone pairs and formal charges.

- a. When *sec*-butyl benzene undergoes free-radical bromination, one major product is formed. If the starting material is chiral and optically active, predict whether or not the product is optically active. Show the mechanism:

