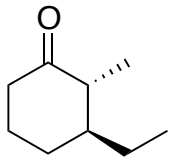
Chem 331 Fall 2011 KEY for Exam 1

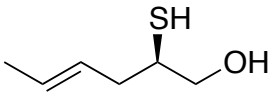
Your Name_____

1. Draw the structure (5 points each)

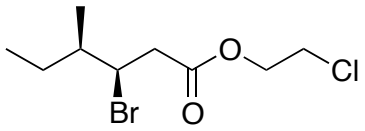
(2*R*,3*S*)-3-ethyl-2-methylcyclohexanone



(2*R*,4*E*)-2-mercaptohex-4-en-1-ol



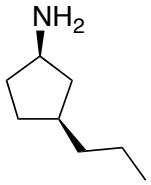
2. Give IUPAC names for each molecule (5 points each)



(3*R*,4*R*)-2-chloroethyl 3-bromo-4-methylhexanoate

ALSO ACCEPTED:

2-chloroethyl (3*R*,4*R*)-3-bromo-4-methylhexanoate



(1*R*,3*S*)-3-propylcyclopentanamine

Your Name_____

3. For each pair of structures, indicate if they are the same, enantiomers, or diastereomers. If the none of these terms accurately describe the molecules, then circle “none of the above”
(5 points each)

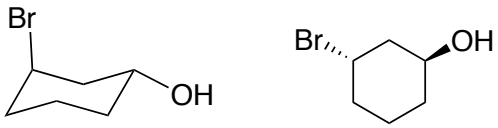
(a) 

same

enantiomers

diasteromers

none of the above

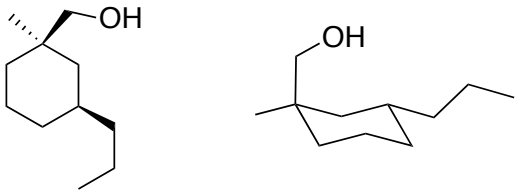
(b) 

same

enantiomers

diasteromers

none of the above

(c) 

same

enantiomers

diasteromers

none of the above

(d) 

same

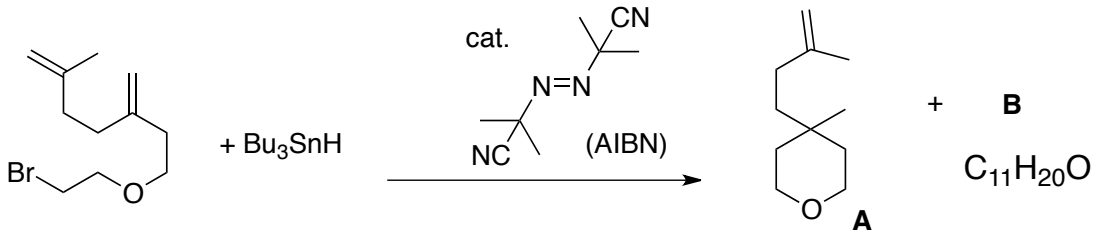
enantiomers

diasteromers

none of the above

Your Name_____

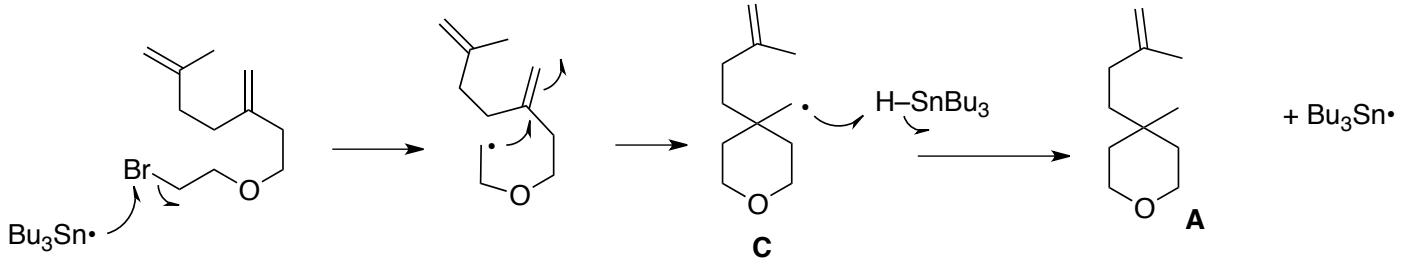
4. The reaction below produces two products, **A** and **B**



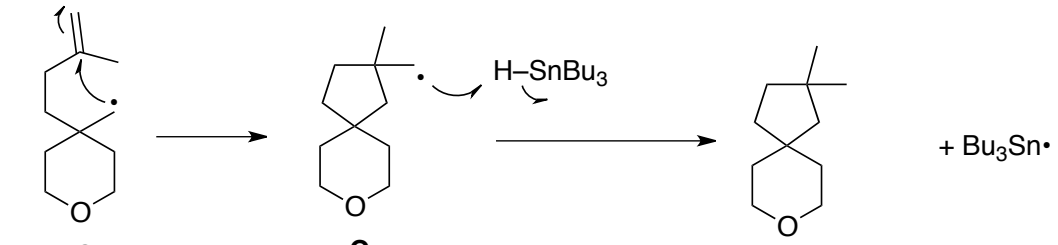
^{13}C NMR of **B**

64.9, t (2 carbons)
54.6, t
42.5, t
40.4, s
37.6, s
37.2 , t (2 carbons)
28.3, q (2 carbons)
26.2, t

a. Provide a mechanism for the formation of **A** (8 points)
b. Provide a structure for **B** and a mechanism for it's formation (12 points)

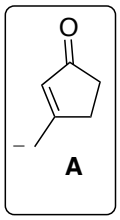


for the formation of **B**

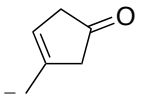


5a. Anion **A** is more stable (lower in energy) than **B**– explain why?
Draw and compare resonance structures for **A** and **B** in support of your answer. It is NOT necessary for you to depict orbitals.

8 points

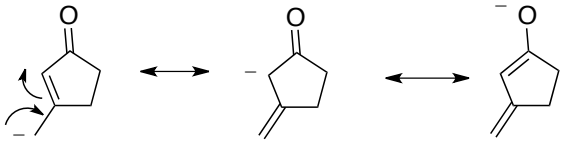


A

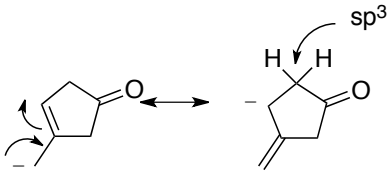


B

A is lower in energy. For **A**, there are three resonance structures, including a stabilizing resonance with the carbonyl group



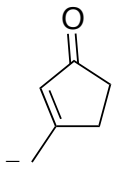
for **B**, there is only resonance with the alkene. There is no valid resonance structure with the carbonyl.



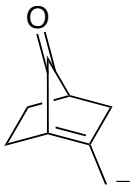
because an sp^3 center separates the carbonyl and the anion, there can be no pi-conjugation.

5b. Anion **A** is more stable (lower in energy) than **C**– explain why?
Draw a clear orbital picture and less than 30 words to explain why.

12 points

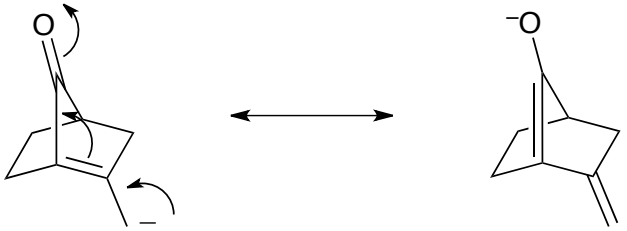


A

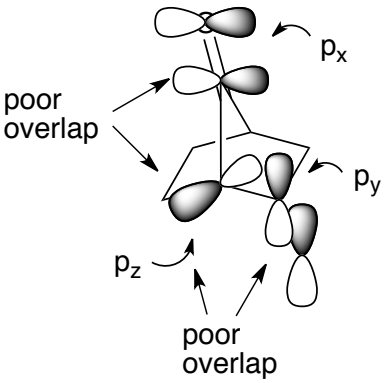


C

Anion **A** is conjugated as described above. We can also write resonance structures for **C**, as shown below.



However, the orbitals that would make up this are completely deconjugated, being composed of orbitals oriented in the x, y and z planes. The anion of **C** is not able to delocalize!



side view