350 Organic Chemistry I
Exam #4B, December 4, 2017

Winona State University
Professor T. Nalli

Name_____

General Instructions: Write your name in the space provided above and on the provided Scan-tron form.
Do not put your name anywhere else in this exam book

Grading: Grading will be on the basis of a highest possible score of 100 points.

I. Multiple Choice - 2 points each, 30 points total

III. Reaction Products - 5 points each, 40 points total

IV. Mechanism – 10 points each, 20 points total

V. Synthesis – 5 points each, 10 points total

VII. Extra Credit (Multiple Choice Research Study Participation)– 5 points

I. Multiple Choice - 2 points each, 30 points total (Answer on the Scan-Tron form)

1. What is the formula of 2,6-dimethylhept-3-yne?
   A. C_9H_{16} B. C_9H_{20} C. C_9H_{19} D. C_9H_{16}

2. Which of the following is the strongest acid?
   A. 2-butene B. 1-butene C. 2-butyne D. 1-butyne

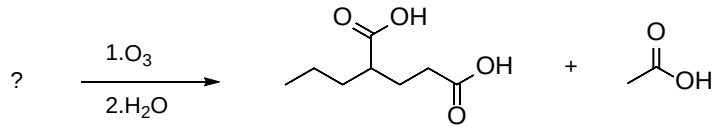
3. Which base does not work for the formation of an acetylide ion from a terminal alkyne?
   A. NaOH B. $LiCH_3$ C. NaH D. $NaNH_2$

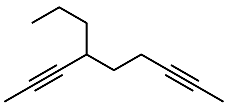
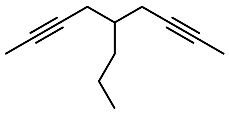
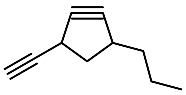
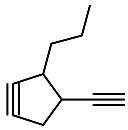
4. In 2-pentyne, what is the C-C-C bond angle at C-2?
   A. approx 109.5° B.approx 120° C. 60° D. 180°

5. Which of these alkynes cannot be easily prepared in good yield from ethyne?
   A. 1-hexyne B. 3-hexyne C. 5,5-dimethyl-1-hexyne D.4,4-dimethyl-2-hexyne

6. Which of these reagents can be used to accomplish anti-Markovnikov hydration of terminal alkynes?
   A. Disiamylborane (Sia_2BH)
   B. Sodium Borohydride ($NaBH_4$)
   C. 9-Borabicyclo[3.3.1]nonane
   D. Both choices A and B can be used
   E. Both choices A and C can be used

7. What is the most likely structure for the diyne gives the products below upon ozonolysis?



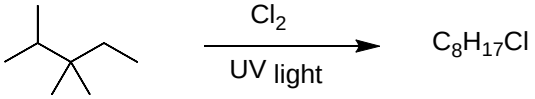
A.  B.  C.  D. 

8. Rank the following radicals in order of decreasing stability (most stable to least stable).

I.  II.  III. 

   A. I > II > III B. II > III > I C. III > II > I D. II > I > III E. III > I > II

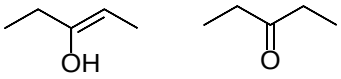
9. How many total different constitutional isomers are formed as products in the monochlorination of 2,3,3 - trimethylpentane as shown below? (Do not count enantiomers!)



   A. 3 B. 4 C. 5 D. 2 E. 6

10. How can the production of dichlorinated and trichlorinated products in a radical chlorination reaction be minimized?
    A. Use exactly 1.0 equiv Cl_2
    B. Use excess Cl_2
    C. Use excess of the substrate
    D. Run the reaction at low temperature

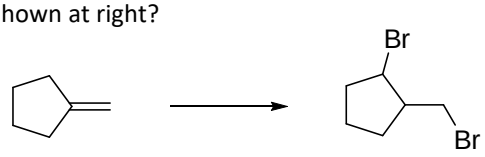
11. What is the relationship between the molecules shown at right?



A. diastereomers B. tautomers C. enantiomers D. conformers E. resonance structures

12. Which reaction sequence accomplishes the synthetic transformation shown at right?

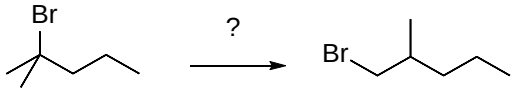
A. 1. NBS, hv, heat 2. Br_2, hv
B. 1. HBr, ROOR 2. HBr, ROOR
C. 1. 9-BBN 2. H_2O_2, OH^- 3. HBr 4. Br_2, hv
D. 1. H_3O^+ 2. H_2O_2, OH^- 3. HBr 4. Br_2, hv



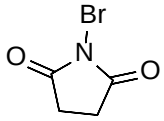
13. Which of these most accurately describes the composition of the Lindlar catalyst?
A. $PhCH_2N^+(Et)_3$ Cl^- and NMO B. Ni_2B and MeOH C. Pd, $Pb(OAc)_2$, and quinoline D. $Rh(PPh_3)_3Cl$ and H_2O_2

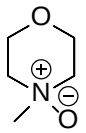
14. Which reaction sequence accomplishes the synthetic transformation shown at right?

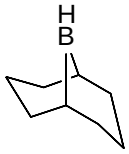
A. 1. NaH 2. HBr, ROOR
B. 1. NaH 2. NaBr, DMSO
C. 1. TsCl 2. NaBr, DMSO
D. 1. KO-t-Bu 2. HBr, ROOR
E. 1. KO-t-Bu 2. NBS



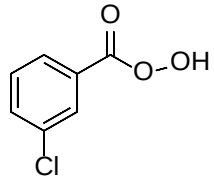
15. Which compound is usually referred to as NBS?

A. 

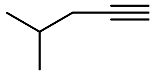
B. 

C. 

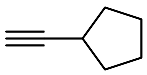
D. 

E. 

III. Give the structure of the major organic product of each of the following reactions. (If the product can exist as more than one stereoisomer then be sure to show explicitly which stereoisomers are actually formed.)

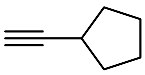
1.  $\xrightarrow[\text{HgSO}_4\text{(cat)}]{\text{H}_2\text{O}\ /\ \text{H}_2\text{SO}_4\text{(cat)}}$

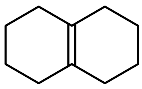
2. $CH_3-C\equiv C-Ph$ $\xrightarrow{Br_2\ (1\ equiv)}$

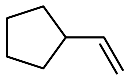
3.  $\xrightarrow[2.\ \text{Br}]{1.\ NaNH_2}$

4. $CH_3-C\equiv C-Ph$ $\xrightarrow{HCl(xs)}$

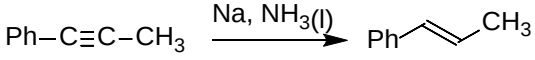
5. $CH_3-C\equiv C-Ph$ $\xrightarrow[\text{Lindlar Catalyst}]{H_2}$

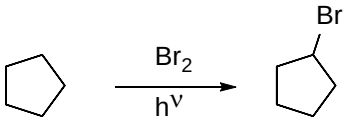
6.  $\xrightarrow{HBr\ (xs)}$

7.  $\xrightarrow[\text{heat}]{\text{NBS, h}\nu}$

8.  $\xrightarrow[\text{ROOR}]{\text{HBr}}$

IV. Write out the mechanism of each reaction shown. Used curved arrows to show the movement of electrons in each step.





V. Give a sequence of reactions, showing all necessary reagents, by which the following transformations can be accomplished. (In other words, replace the question marks with the reagents needed.) Explain how each part of the synthesis works by showing intermediate products of each synthetic step.