

**5.12**

**Prof. B. Imperiali**

## **Practice Exam #3**

**Exam will be held on Monday April 14th at noon.**

**Notes and calculators will not be allowed in the exam but you will be provided with a periodic table and you may bring use molecular models to use.**

**The exam will cover material from 3/12-4/11.**

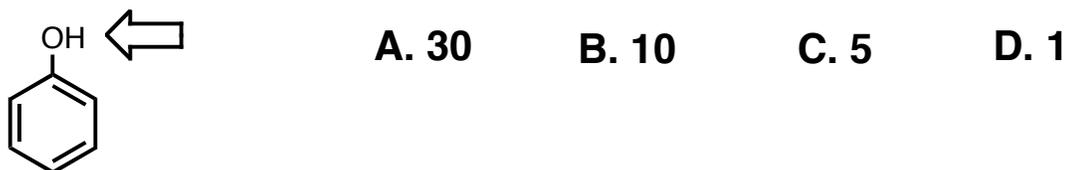
**The practice exam key will be posted as a separate file so that you can print up the exam and take it as a “real practice” before you check out the answers.**

Page 2 Short questions (1-9 3 points each and 10-12 4 points)

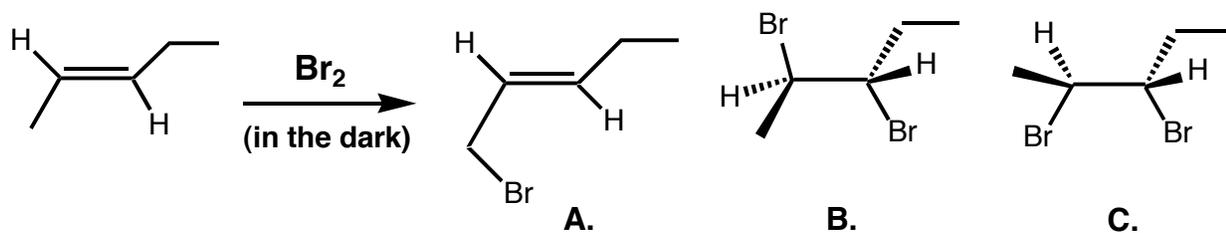
1. Estimate the  $pK_a$  of the proton indicated.



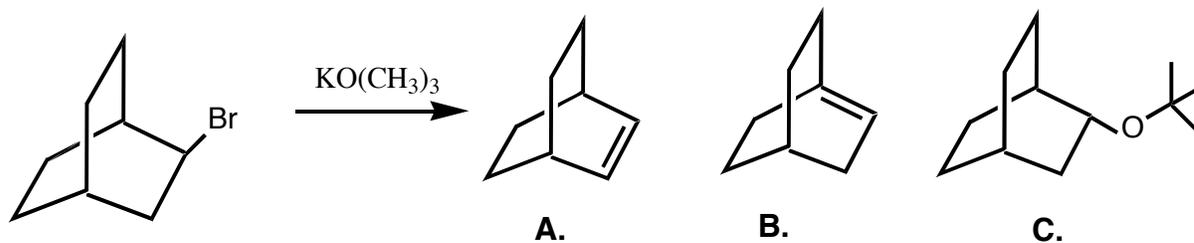
2. Estimate the  $pK_a$  of the proton indicated.



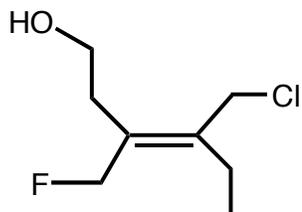
3. Identify the major product of the reaction shown.



4. Identify the major product of the reaction shown.



5. Which of the following terms is the best description of the alkene shown below.



A. Cis Alkene

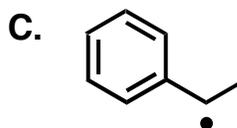
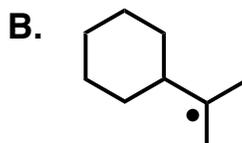
B. Trans Alkene

C. Z Alkene

D. E Alkene

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6. Which of the following is the most stable free radical?



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7. Which of the following compounds are formed when ethene is bubbled into an aqueous solution of bromine and sodium chloride?



A. I and II

B. I and III

C. II and III

D. I, II and III

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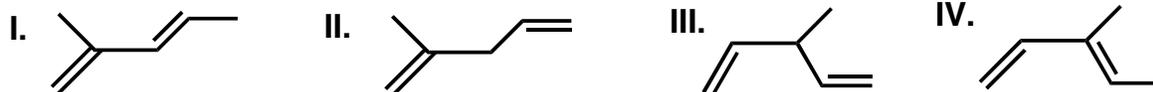
8. Which of the following reagents effectively cleaves carbon-carbon double bonds?

A.  $\text{Br}_2$  and light

B. meta-chloroperoxybenzoic acid

C.  $\text{OsO}_4$  followed by  $\text{H}_2\text{O}_2$ D.  $\text{O}_3$  followed by  $(\text{CH}_3)_2\text{S}$

9. Ozonolysis of an unknown compound gave  $\text{CH}_2=\text{O}$ ,  $\text{CH}_3\text{CHO}$  and  $\text{CH}_3\text{COCHO}$ . What are possible structures for the unknown compound?



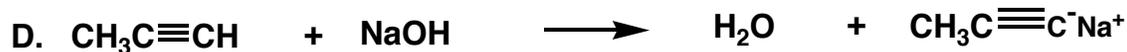
A. I and II

B. I and IV

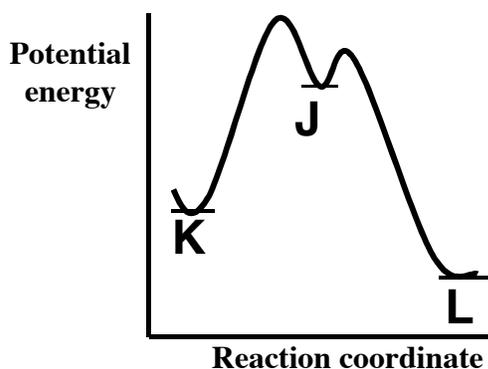
C. II and III

D. II and IV

10. Which of the following reactions does NOT occur as shown



11. Compound J undergoes a rearrangement to yield compounds K and L. Based on the potential energy diagram below which of the following statements is true?



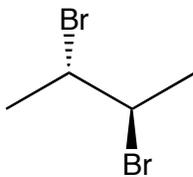
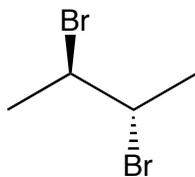
A. K is formed faster and is more stable than L.

B. K is formed faster and is less stable than L.

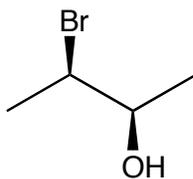
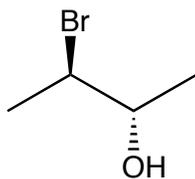
C. L is formed faster and is less stable than K.

D. L is formed faster and is more stable than K.

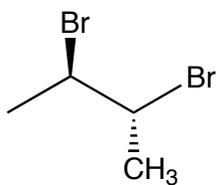
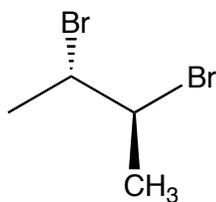
12. Label the following pairs of molecules as E (enantiomers), D (diastereomers), or S (same molecule).



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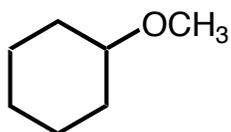
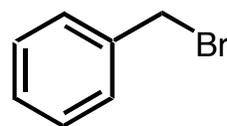
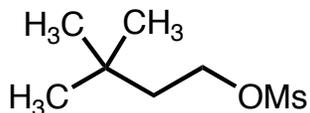
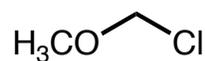
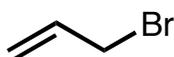
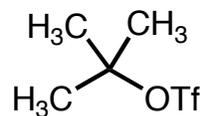


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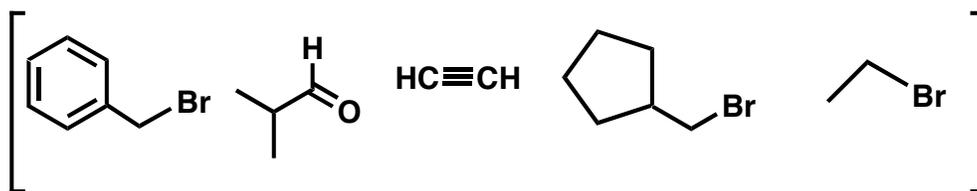
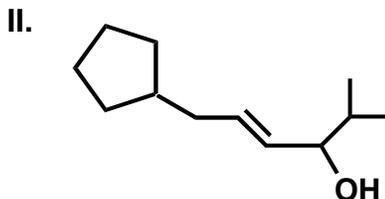
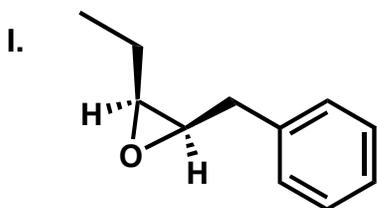


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13. (16 points) For the following compounds, indicate whether they will react under  $S_N1$  conditions (EtOH,  $\Delta$ ),  $S_N2$  conditions (KI/acetone), **both**, or **neither**. Indicate the products and by which mechanism they are produced.



14. (20 points) Design syntheses of compounds I and II (10 points each). The pool of carbon-containing starting materials that you can use are shown in the square brackets. You may use any other common reagents.



Note: a clear retrosynthetic analysis will be useful for figuring these problems out. Partial credit will be given for a retrosynthetic analysis even if the synthesis is incomplete.

15. (24 points) Provide a detailed stepwise mechanism to account for the following transformations. 8 points each.

