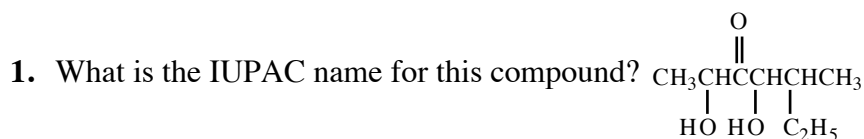


**Chemistry 2542**  
**Spring 2008; Sample Final Exam**

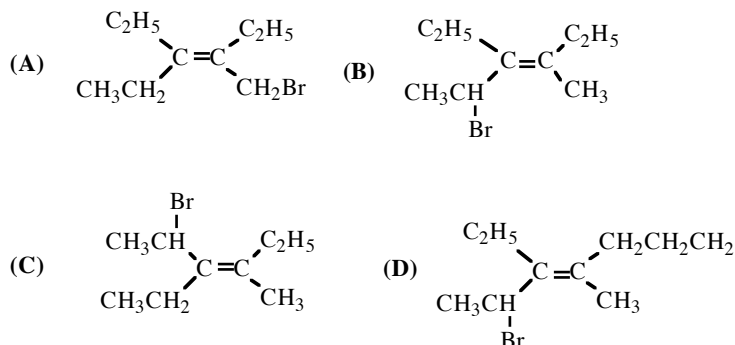
**Directions:**

For each of the following questions 1-70 select one item that is the correct answer. Do not mark anything in the test booklet: you will be provided with a special answer sheet. Bring a soft, black #2 pencil with you. Your score is based on the number of questions you answer correctly. The best strategy is to arrive at your own answer before looking at the choices. Otherwise, you may be misled by plausible, but incorrect, responses.

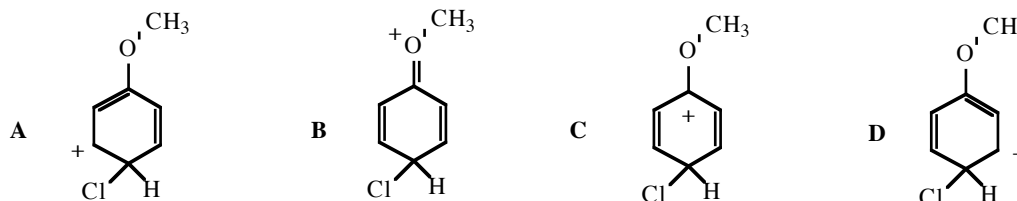
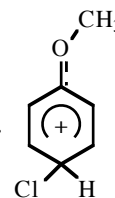


- (A) 2,4-(dihydroxy)-5-methyl-3-heptanone  
 (B) 2,4-(dihydroxy)-5-ethyl-3-hexanone  
 (C) 5-methyl-2,4-(dihydroxy)-3-heptanone  
 (D) 3,5-(dihydroxy)-2-ethyl-4-heptanone

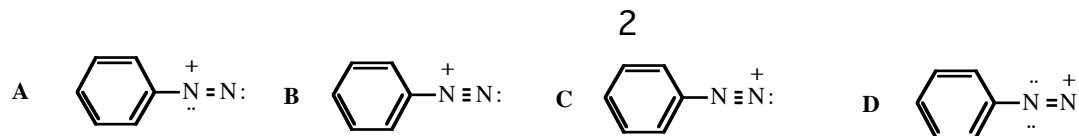
2. Which compound is (Z)-2-bromo-3-ethyl-4-methyl-3-hexene?



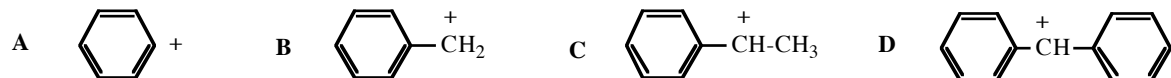
3. Identify the most important resonance contributor to the resonance hybrid of this compound.



4. Which is an acceptable Lewis structure for phenyldiazonium cation,  $\text{PhN}_2^+$ ?



5. The most stable carbocation is

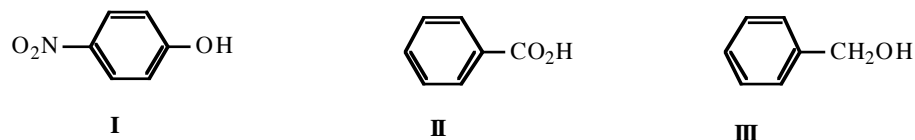


6. Which structure is aromatic?



7. When 1.00 g of cyclohexanol (molar mass 100) is converted to give 0.71 g of cyclohexyl acetate (molar mass 142), the percent yield is: (A) 71.0%; (B) 70.4%; (C) 50.0%; (D) 29.0%

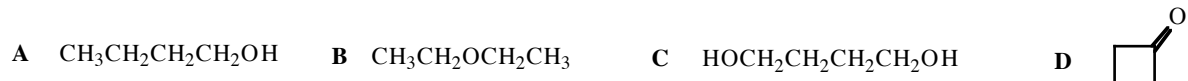
8. Which, when dissolved in hexane, will extract into aqueous sodium hydroxide? Skip this question



(A) I and III; (B) II and III; (C) I and II; (D) III only

9. When cyclohexane and water are mixed in a separatory funnel, (A) two layers will form; (B) cyclohexane will dissolve in water to form a homogeneous solution; (C) cyclohexane will react with water to form an alcohol; (D) cyclohexane will partially mix with water forming three layers.

10. Which of the following compounds has the highest boiling point?



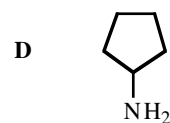
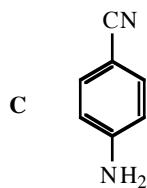
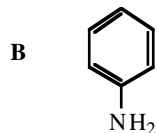
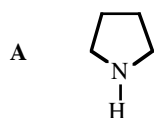
11. Identify the strongest acid: (A)  $\text{NCCH}_2\text{COOH}$ ; (B)  $\text{CH}_3\text{COOH}$ ; (C)  $\text{C}_2\text{H}_5\text{COOH}$ ; (D)  $\text{NC}(\text{CH}_2)_2\text{COOH}$

12. Which of these is a Lewis acid?

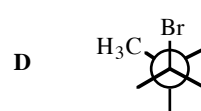
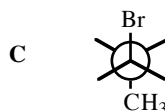
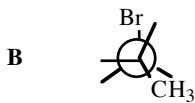
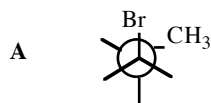


13. Identify the strongest base:

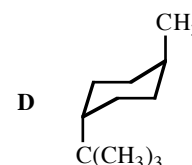
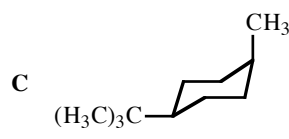
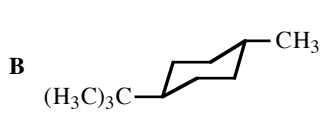
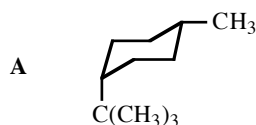
3



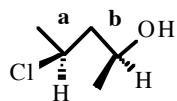
14. Which projection represents the most stable conformation of 1-bromopropane?



15. Which is the most stable conformation trans-1-tertbutyl-4-methylcyclohexane?



16. Give the configuration of stereocenters **a** and **b**

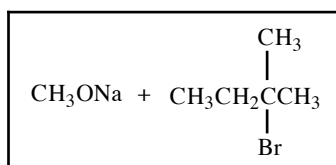


A, S,R; B, S,S; C, R,S; D, R,R

17. How many stereoisomers will be formed from the addition of bromine to (E)-2-hexene?

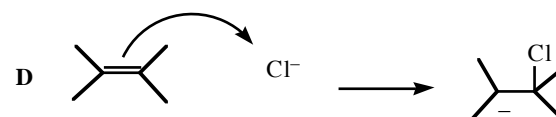
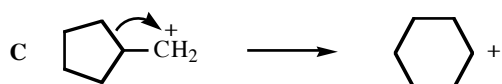
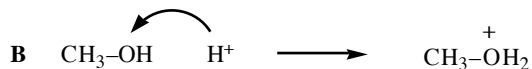
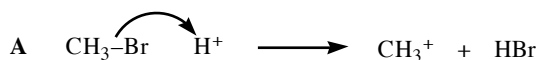
A one; B two; C three; D four

18. Which is a principal product of this reaction?



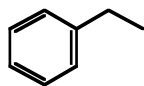
A  $\text{CH}_3\text{CH}_2(\text{CH}_3)_2\text{C}(\text{OCH}_3)$ ; B  $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$ ; C  $\text{CH}_2=\text{CHCH}(\text{CH}_3)_2$ ; D  $\text{CH}_3\text{CH}_2(\text{CH}_3)\text{C}=\text{CH}_2$

19. Which reaction step is reasonable?



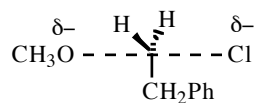
20. How many signals would you expect in the proton-decoupled carbon-13 magnetic resonance spectrum of

this compound?



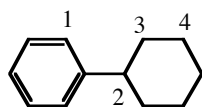
A 8; B 7; C 6; D 5

21. The species shown represent the transition state for the reaction of



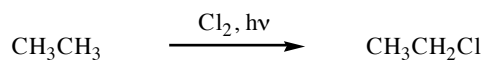
A 1-chloro-2-phenylethane and methanol B 1-chloro-1-phenylethane and methanol  
C 1-chloro-2-phenylethane and methoxide anion  
D 1-hydroxy-2-phenylethane and chloromethane

22. Which of the positions marked would be the most reactive in a free radical reaction?



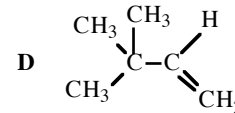
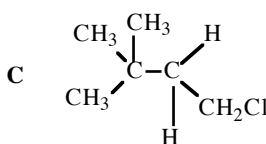
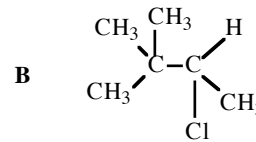
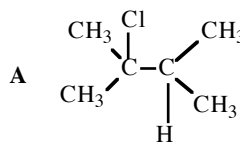
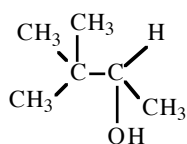
A 1; B 2; C 3; D 4

23. An intermediate in this reaction is

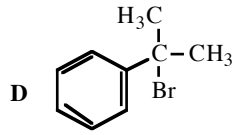
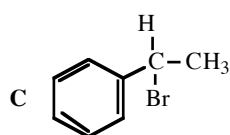
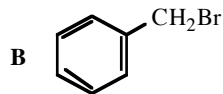
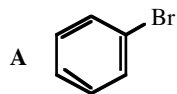


A  $\text{CH}_3\text{CH}_2^\bullet$ ; B  $\text{CH}_2=\text{CH}_2$ ; C  $\text{CH}_3\text{CH}_2^+$ ; D  $\text{CH}_3\text{CH}_2^-$

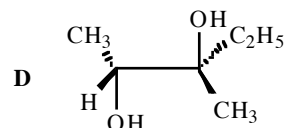
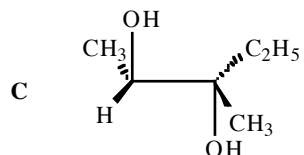
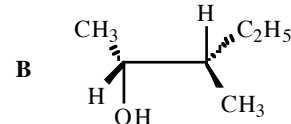
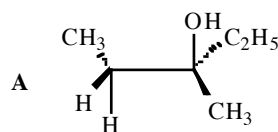
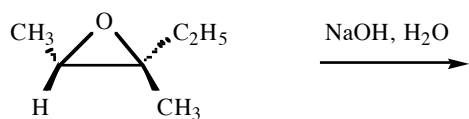
24. Predict the major product of the reaction.



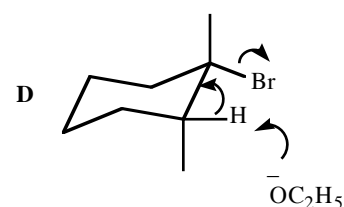
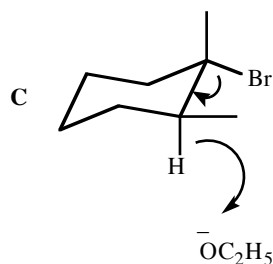
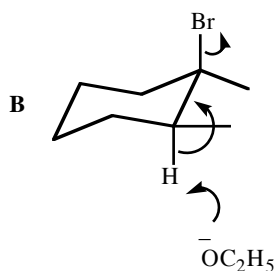
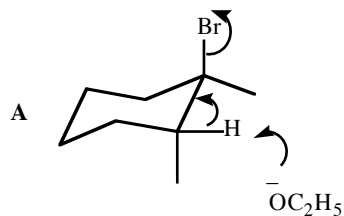
25. Which compound is the most reactive in  $\text{S}_{\text{N}}2$  reaction?



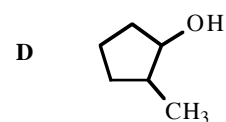
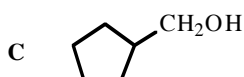
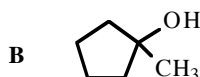
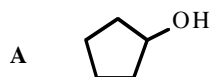
26. What is the product of the reaction?



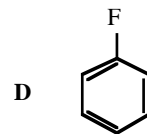
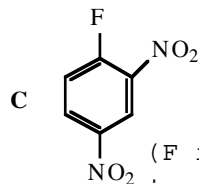
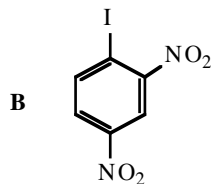
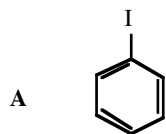
27. Identify the correct representation of E2 mechanism



28. Which alcohol dehydrates most rapidly in the presence of acid?

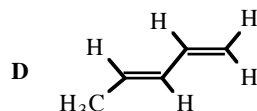
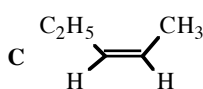
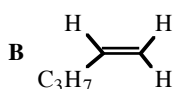
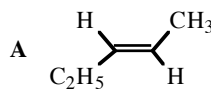
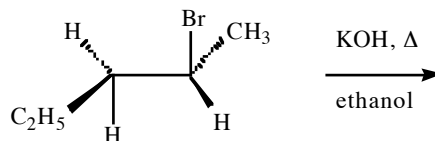


29. Which compound reacts most rapidly with NaOH? (skip this problem)

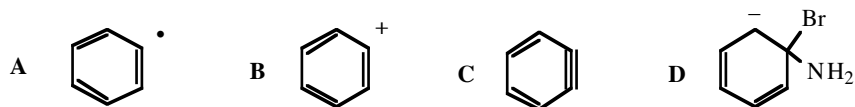
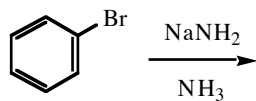


(F is a better leaving group in aromatic nucleophilic substitution)

30. What is the major product of the reaction?



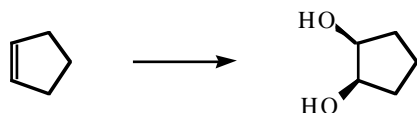
31. Which intermediate is involved in this reaction?



32. Addition of bromine to (Z)-2-butene will give:

A one meso compound; B one pair of enantiomers; C four stereoisomers; D two meso compounds

33. Which set of reagents would be best for this conversion?



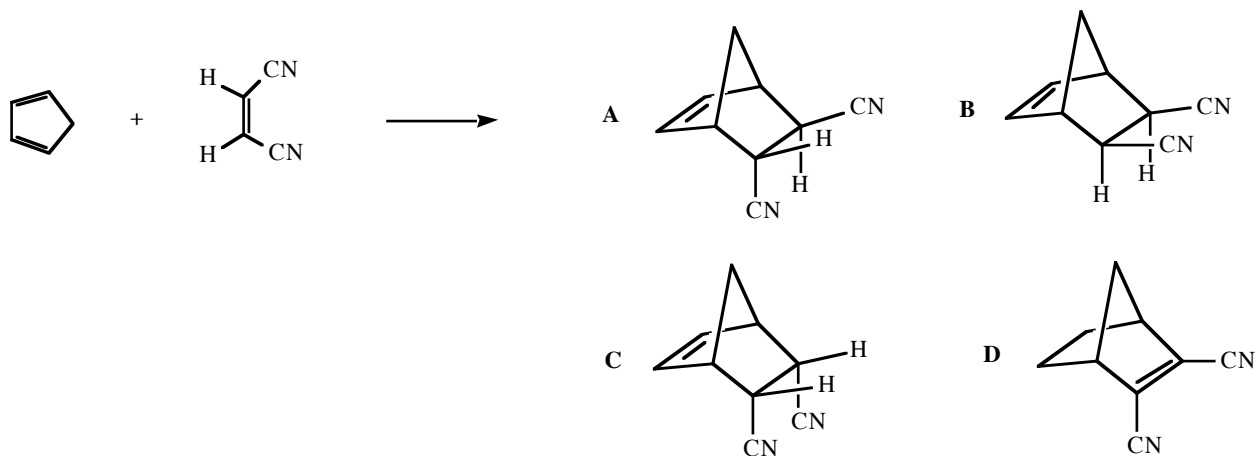
A  $\text{CH}_3\text{CO}_3\text{H}$ , then  $\text{NaOH}/\text{H}_2\text{O}$ ; B  $\text{H}_3\text{O}^+$ ; C  $\text{OsO}_4(\text{cat.}), \text{H}_2\text{O}_2$ ; D  $\text{CrO}_3, \text{H}_2\text{SO}_4$

34. Which products would be formed in this reaction?

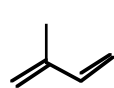


A 3,4-dichloro-1-butene and 1,2-dichloro-1-butene  
 B 3,4-dichloro-1-butene and 1,4-dichloro-2-butene  
 C 3,4-dichloro-1-butene and 1,2-dichloro-3-butene  
 D 3,4-dichloro-1-butene only

35. Which is the major product of this Diels-Alder reaction?

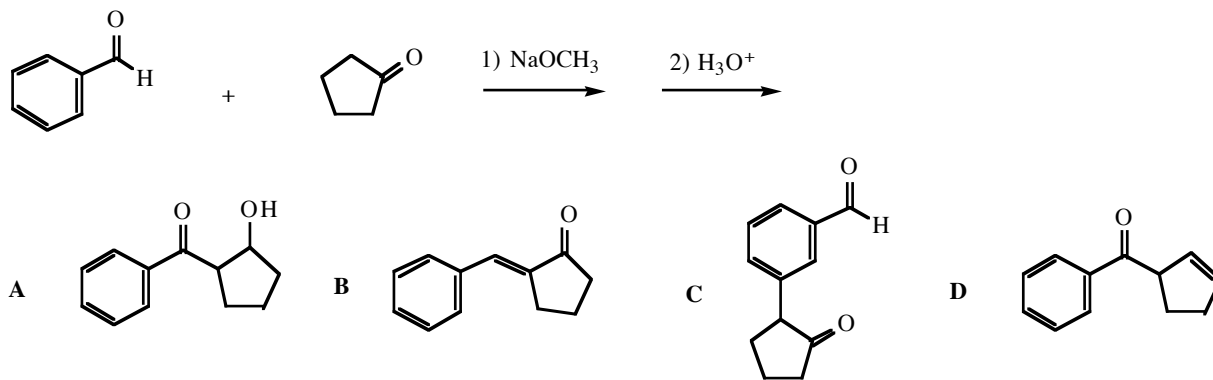


36. Free radical polymerization of the diene would produce what polymer?

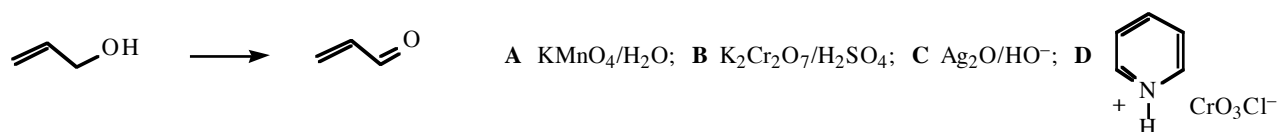


A  $(-\text{CH}_2-\overset{\text{CH}_3}{\text{CH}}-\text{CH}=\text{CH}-)_n$  B  $(-\text{CH}=\overset{\text{CH}_3}{\text{C}}-\text{CH}=\text{CH}-)_n$   
 C  $(-\text{CH}_2-\overset{\text{CH}_3}{\text{C}}=\text{CH}-\text{CH}_2-)_n$  D  $(-\text{CH}_2-\overset{\text{CH}_3}{\text{CH}}-\text{CH}_2-\text{CH}_2-)_n$

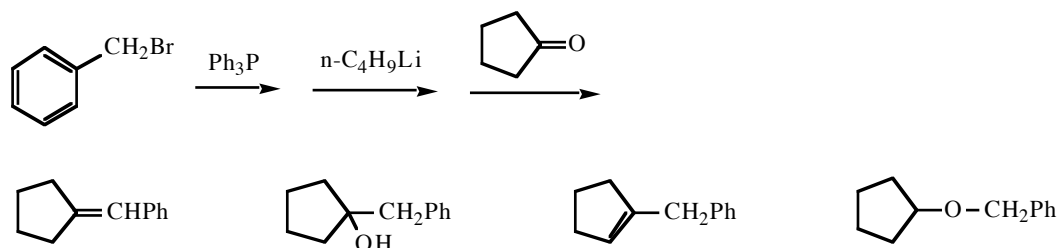
37. Which is the major product of this reaction?



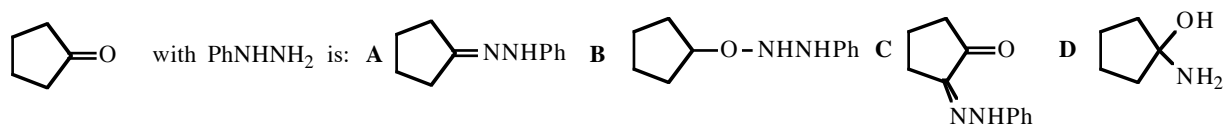
38. Which reagent will best accomplish this transformation?



39. What is the product of this reaction sequence?

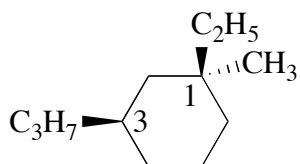


40. The product expected from the reaction of



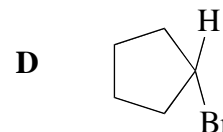
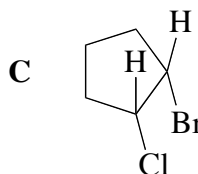
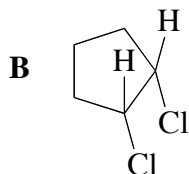
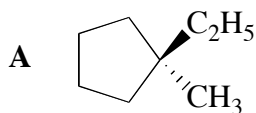
## ADDITIONAL PROBLEMS (Spring 2006)

1. What is the correct configuration of the following molecule?

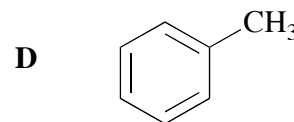
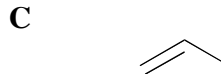
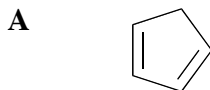


A 1*S*, 3*S*    B 1*S*, 3*R*    C 1*R*, 3*S*    D 1*R*, 3*R*

2. Which molecule is optically active?



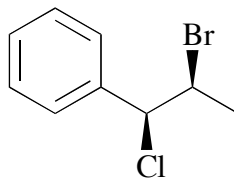
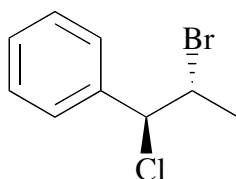
3. Which molecule can be easily deprotonated with NaOH in water?



4. Which pair has the same boiling point?

- A *cis*-1,3 dichlorocyclopentane and *trans*-1,3 dichlorocyclopentane  
 B (*R*)-2-butanol and (*S*)-2-butanol  
 C (2*R*,3*S*)-3-bromo-2-butanol and (2*R*,3*R*)-3-bromo-2-butanol  
 D 1-butanol and 2-butanol

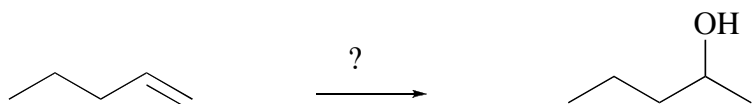
5. What kind of isomers are the following two molecules?



- A enantiomers  
 B diastereomers  
 C conformers  
 D constitutional

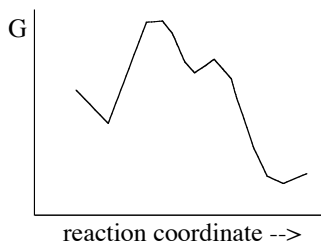
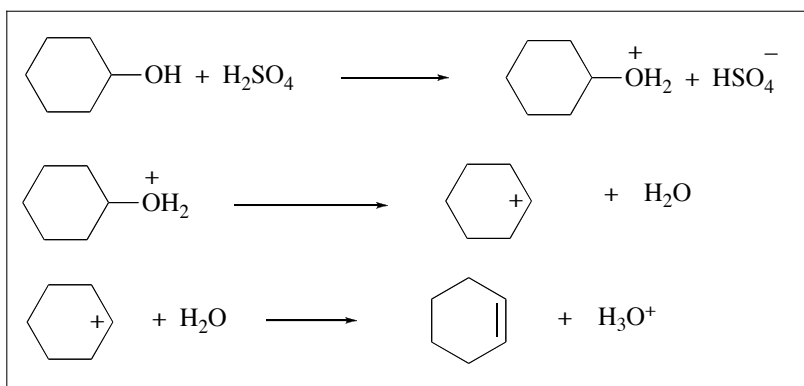


6. Which reagents will accomplish the following transformation?

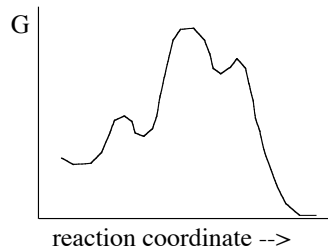


- A** 1)  $\text{BF}_3 \cdot \text{THF}$ , 2)  $\text{H}_2\text{O}_2$ ,  $\text{NaOH}$ ,  $\text{H}_2\text{O}$      
 **B**  $\text{F}_3\text{C}-\text{C}(=\text{O})-\text{O}-\text{O}-\text{H}$      
 **C**  $\text{OsO}_4$ ,  $\text{H}_2\text{O}_2$   
**D** 1)  $\text{Hg}(\text{OAc})_2$ ,  $\text{H}_2\text{O}$ ; 2)  $\text{NaBH}_4$

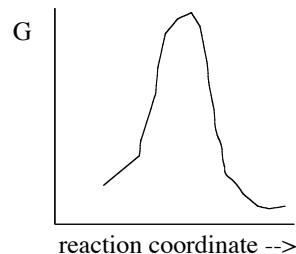
7. Which energy diagram corresponds to the following mechanism?



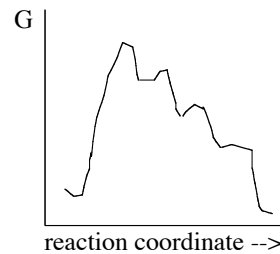
**A**



**B**

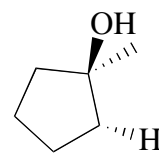
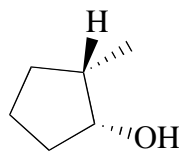
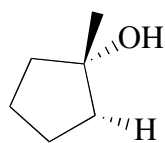
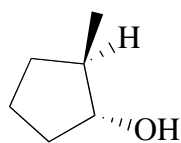
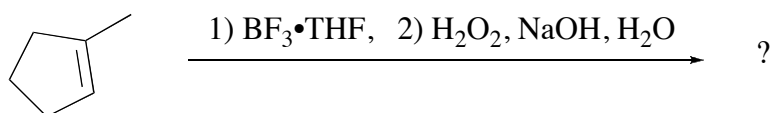


**C**

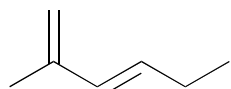
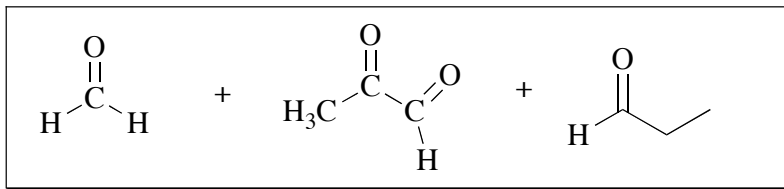


**D**

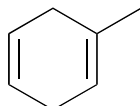
8. What is the major product of the following reaction?



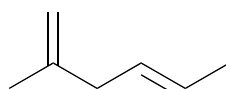
9. Which structure will produce the following products upon ozonolysis?



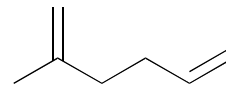
A



B

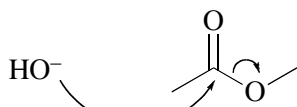


C



D

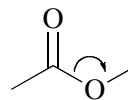
10. Which represents the first step in saponification of methyl acetate?



A



B

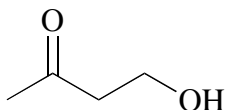
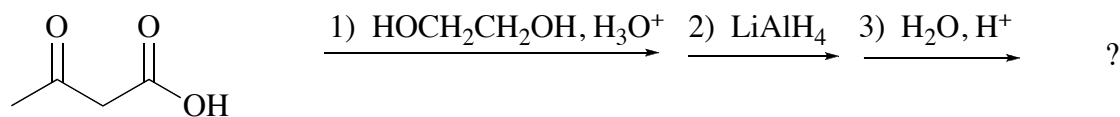


C

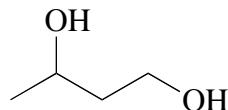


D

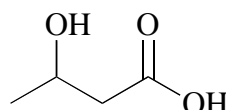
11. Which is the product of this reaction sequence?



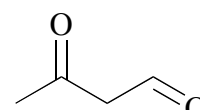
A



B



C



D

Answers: 1. B; 2. C; 3. A; 4. B; 5. B; 6. D; 7. B; 8. A; 9. A; 10. B; 11. A