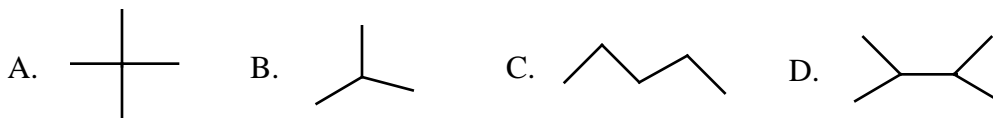


1. What are the reagents and conditions necessary to complete the following reaction?



- A. Zn, HBr    B. Br<sub>2</sub>, Ni (catalyst)    C. Br<sub>2</sub>, light    D. Br<sup>-</sup>, light
2. Which of these choices correctly describes the positions of the isopropyl and hydroxyl groups in the most stable conformation of *cis*-4-isopropylcyclohexanol:
- A. isopropyl equatorial, OH equatorial  
 B. isopropyl axial, OH axial  
 C. isopropyl equatorial, OH axial  
 D. isopropyl axial, OH equatorial

3. Which of the following alkanes has the **lowest** boiling point?



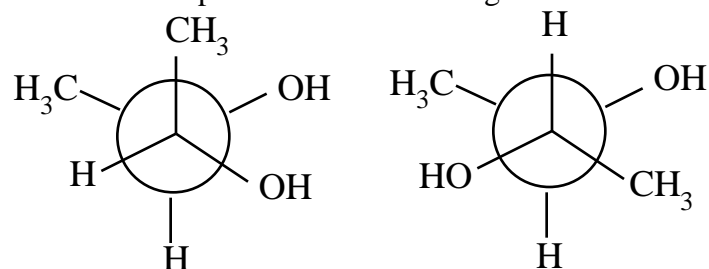
4. Which of the following statements is **NOT** true?

- A. Any molecule with a stereocenter must have a stereoisomer.  
 B. Every meso compound is achiral.  
 C. Any molecule containing tetrahedral stereocenters must be chiral.  
 D. Every chiral compound has an enantiomer.

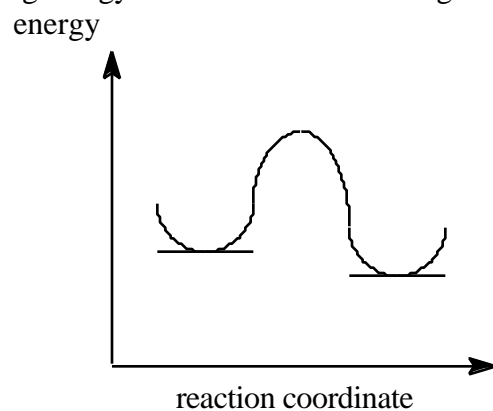
5. What is the percentage of R enantiomer in a sample that has the enantiomeric excess (optical purity) of 60% of the S enantiomer?

- A. 20%    B. 30%    C. 40%    D. 60%

6. What is the relationship between the following structures?

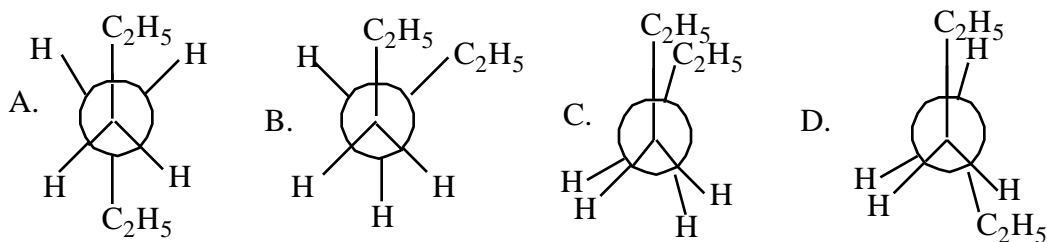


- A. Same compound  
B. Enantiomers  
C. Diastereomers  
D. Structural isomers
7. Which of the following is the slowest-reacting leaving group?
- A.  $\text{OH}^-$     B.  $\text{Br}^-$     C.  $\text{CF}_3\text{SO}_3^-$     D.  $\text{H}_2\text{O}$
8. Which of the following statements is **NOT** true about a reaction represented by the following energy –reaction coordinate diagram:

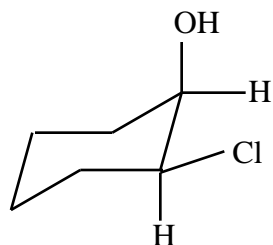


- A. This diagram can represent any  $\text{S}_{\text{N}}2$  reaction.  
B. This diagram can represent any  $\text{E}2$  reaction.  
C. This diagram can represent any exothermic reaction.  
D. This diagram can represent any endothermic reaction
9. Which of the following solvents will accelerate  $\text{S}_{\text{N}}2$  reactions between methyl iodide and  $\text{KOH}$  the most?
- A. DMSO  
B. water  
C. petroleum ether  
D. acetic acid

10. Which of the following represents a *gauche* conformation?

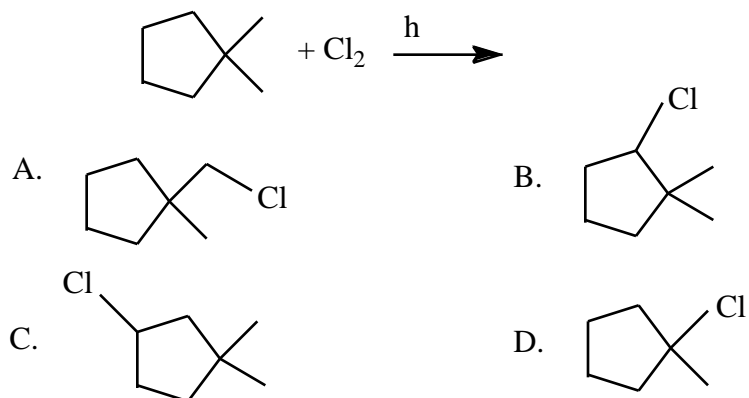


11. What is the IUPAC name of the compound shown?

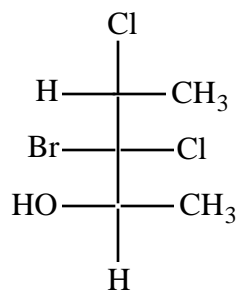


- A. *cis*-1-chloro-2-hexanol  
B. *cis*-1-chloro-2-cyclohexanol  
C. *trans*-2-chlorocyclohexanol  
D. *cis*-2-chlorocyclohexanol

12. Which of the following is **NOT** a product of the reaction shown?

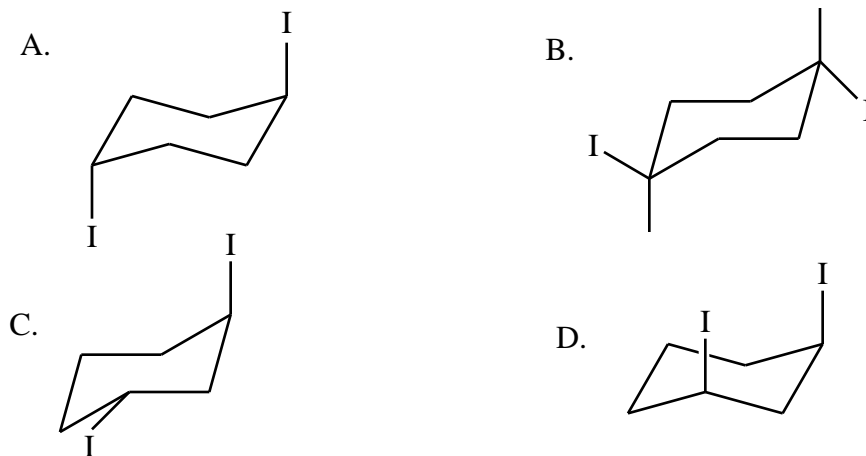


13. What is the IUPAC name of the compound shown?



- A. (2S,3R,4R)-3,4-dichloro-3-bromo-pentanol
- B. (2R,3S,4R)-3-bromo-3,4-dichloro-2-pentanol
- C. (1R,2S,3R)-3-bromo-3,4-dichloro-1-methyl-pentanol
- D. (2R,3S,4S)-3-bromo-3,4-dichloro-2-pentanol

14. Which of the following is a meso compound?



15. What is the relationship between the following two compounds?

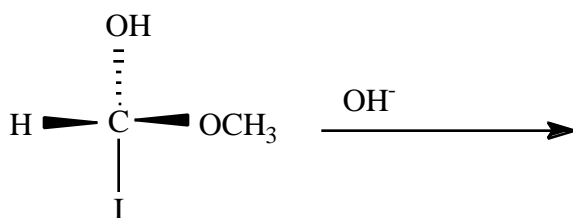


- A. Structural isomers
- B. Not related
- C. Geometric isomers
- D. Same

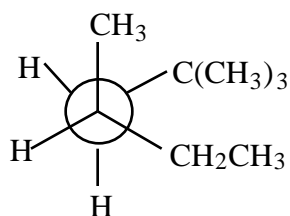
16. Which of the following compounds reacts FASTEST in  $S_N1$  reactions?

- A.  $(CH_3)_3COH$
- B.  $(CH_3)_3Cl$
- C.  $(CH_3)_3CNH_2$
- D.  $(CH_3)_3CBr$

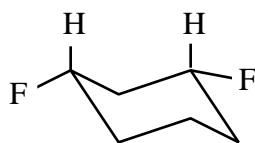
17. Which of the following statements is TRUE about the reaction shown?



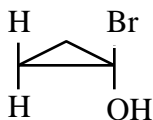
- A. The product is achiral.  
 B.  $\text{OH}^-$  is acting as a base.  
 C. The reaction happens with racemization.  
 D. The reaction happens with retention of configuration.
18. What is the IUPAC name of the compound shown below?



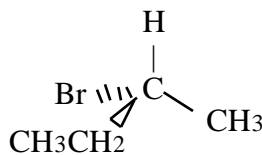
- A. 4-Ethyl-2,2-dimethylpentane  
 B. 2,2,4-Trimethylhexane  
 C. 2-Ethyl-4,4-dimethylpentane  
 D. 1-*tert*-butyl-2-ethylpropane
19. Which of these molecules does **NOT** have a plane of symmetry?



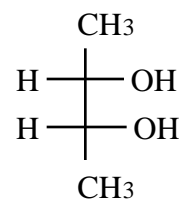
A.



B.

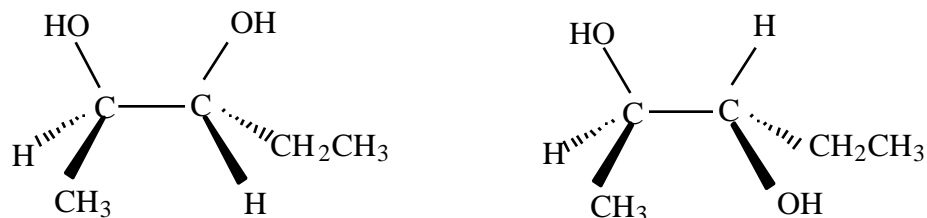


C.



D.

20. What is the relationship between the structures shown?

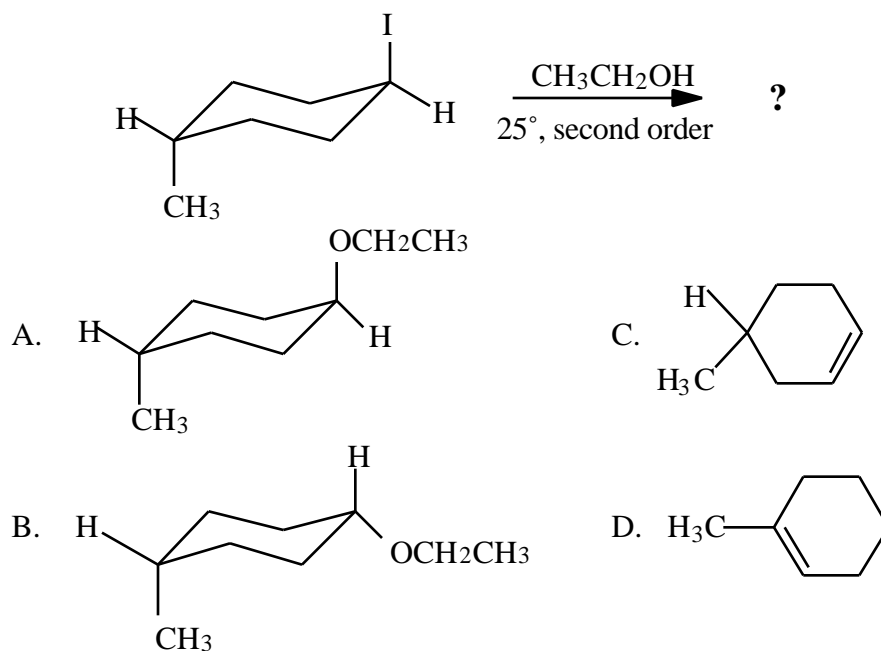


- A. Same compound
- B. Enantiomers
- C. Diastereomers
- D. Structural isomers

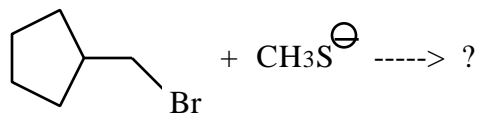
21. Which of these statements is **not** true for a meso compound?

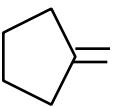
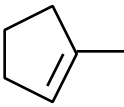
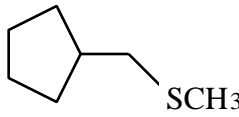
- A. The specific rotation is  $0^\circ$ .
- B. There is at least one plane of symmetry.
- C. A single molecule is superposable on its mirror image.
- D. The stereochemical labels, R and S, must be the same for all stereocenters.

22. What is the major organic product of the following reaction?



23. Which of the following compounds would undergo an  $S_N2$  reaction most RAPIDLY?
- A. 1-chloropentane
  - B. 2-chloro-2-methylbutane
  - C. 2-chloropentane
  - D. Neopentyl chloride
24. In the substitution reaction of  $CH_3Br$  with  $OH^-$ , doubling the concentration of both the substrate and the nucleophile leads to
- A. No change
  - B. Doubling of the rate
  - C. Tripling of the rate
  - D. Quadrupling of the rate
25. What is the major product of the following reaction?



- A.  B.  C.  D. 