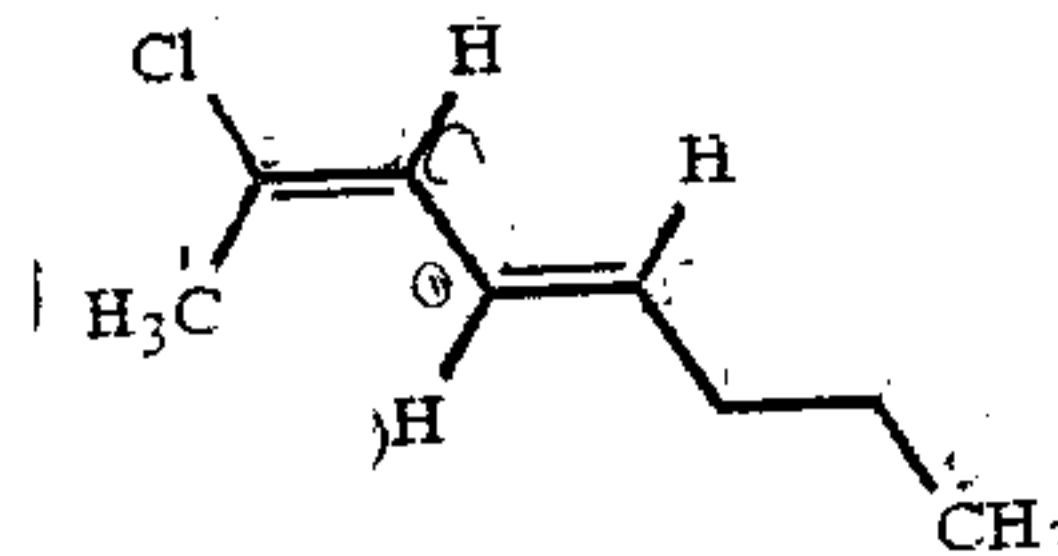


1. What is the correct **IUPAC** name for the compound shown below?

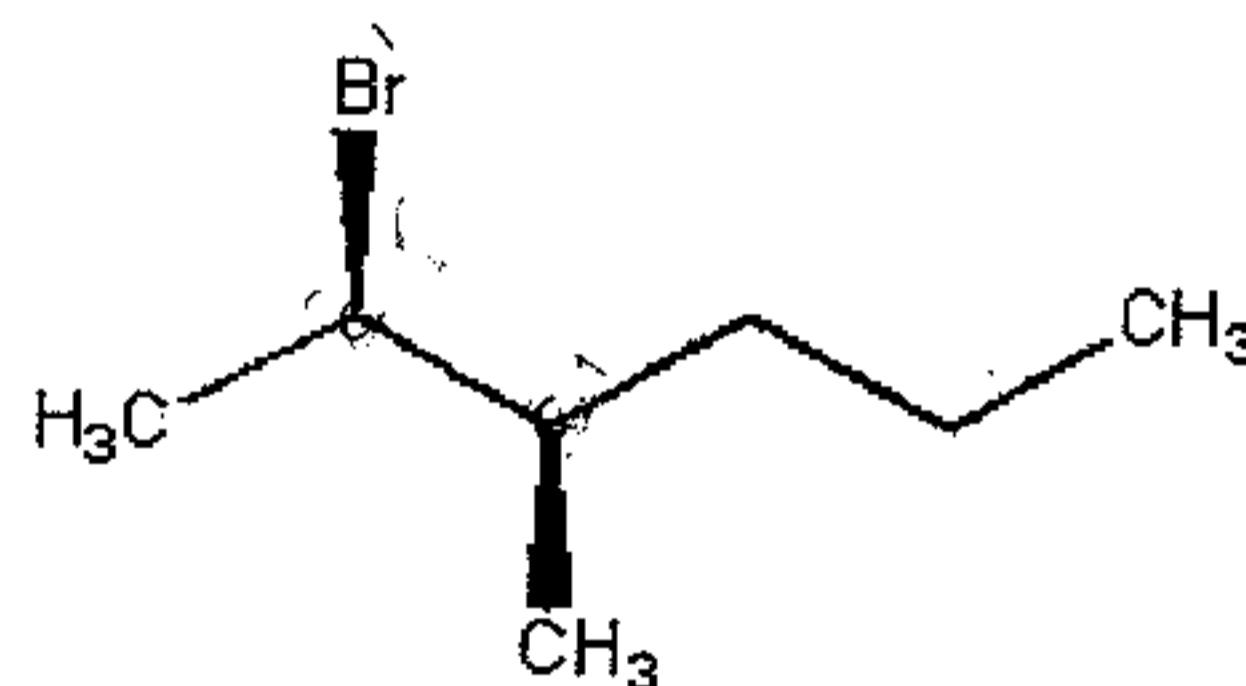


- a) 2-chloro-(2E,4E)-octadiene
- b) cis,cis-2-chlorooctadiene
- c) 2-chloro-(2E,4Z)-octadiene
- d) 2-chloro-(2Z,4E)-octadiene
- e) 2-chloro-(2Z,4Z)-octadiene
2. Which of the following statements **correctly** pertains to a pair of enantiomers?
- a) They rotate the plane of polarized light by exactly the same amount and in opposite directions.
- b) They rotate the plane of polarized light by differing amounts and in opposite directions.
- c) They rotate the plane of polarized light by differing amounts and in the same direction.
- d) They have different melting points.
- e) None of the above is correct.
3. Among the compounds **water**, **1-butyne**, **2-butyne**, and **ethane**, which are stronger acids than ammonia?
- a) 1-butyne and ethane only
- b) water and 1-butyne only
- c) water and ethane only
- d) 1-butyne and 2-butyne only
- e) water, 1-butyne, and 2-butyne only
- 
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Consider the reaction of hydrogen halide with 1-hexyne for questions 4 & 5:

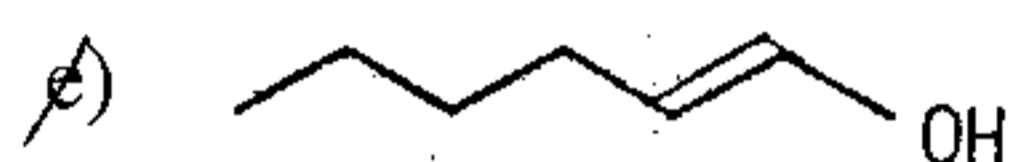
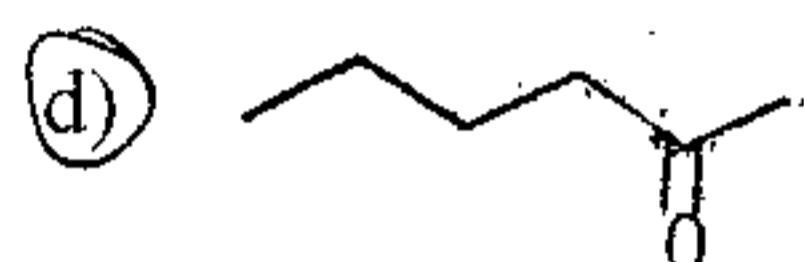
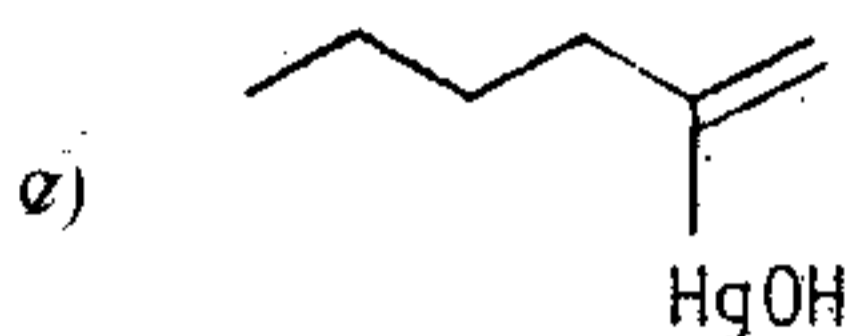
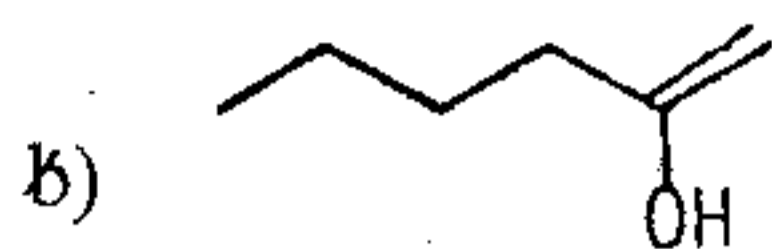
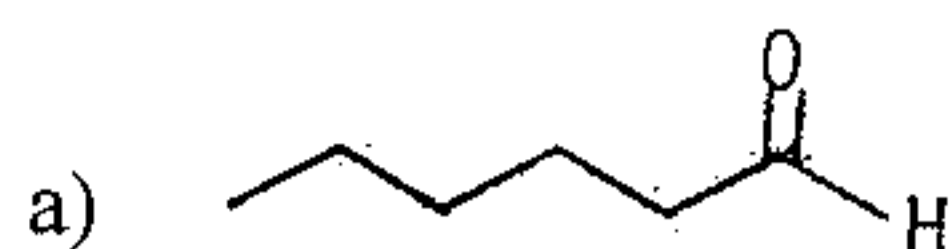
4. What is the major product when only **one** molar equivalent of HBr is used (**no** light)?
- a) 2-bromo-1-hexene
  - b) 1-bromo-2-hexene
  - c) 3-bromo-1-hexene
  - d) 2-bromo-2-hexene
  - e) 1-bromo-1-hexene
5. What is the major product when **two** molar equivalents of HCl is used?
- a) 1,1-dichlorohexane
  - b) 1,2-dichlorohexane
  - c) 2,2-dichlorohexane
  - d) 3,3-dichloro-1-hexene
  - e) 1,2-dichloro-1-hexene

6. What would be the proper name of the compound shown below?



- a) (2S,3S)-2-bromo-3-methylhexane
- b) (2S,3R)-2-bromo-3-methylhexane
- c) (2R,3R)-2-bromo-3-methylhexane
- d) (2R,3S)-2-bromo-3-methylhexane
- e) (4S,3R)-4-bromo-3-methylhexane

7. What is the **major** product of the reaction of 1-hexyne with aqueous  $\text{H}_2\text{SO}_4$ ,  $\text{HgSO}_4$ ?



8. Which of the following is a **geminal** dihalide?

a) cis-1,2-dibromocyclopentane

b) 3,3-dichloropentane

c) trans-1,4-diiodocyclohexane

d) isobutyl chloride

e) 1-bromo-3-chloroheptane

9. Which of the following statements is **true** for the compound (3R,4R)-3,4-dimethylhexane?

a) This compound is chiral.

b) The enantiomer of this compound is (3S,4S)-3,4-dimethylhexane.

c) This compound is a diastereomer of (3R,4S)-3,4-dimethylhexane.

d) All of the above (a, b, and c) are true.

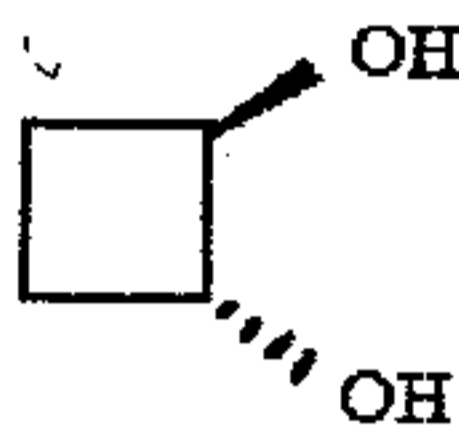
e) None of the above is true.

10. Which of the alkyl chlorides listed below undergo dehydrohalogenation in the presence of a strong base to yield 2-pentene as the **only** alkene product?
- 1-chloropentene
  - 2-chloropentane
  - 3-chloropentane
  - 1-chloro-2-methylbutane
  - 1-chloro-3-methylbutane

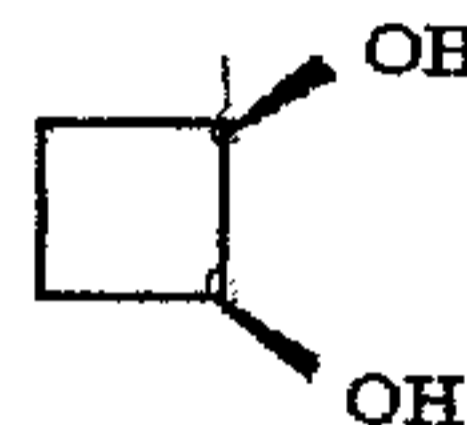
11. Consider the three molecules shown below:



I



II



III

How would each be classified?

- I chiral ; II and III achiral
  - I achiral ; II and III chiral
  - I and III achiral ; II chiral
  - I and III chiral ; II achiral
  - I and II achiral ; III chiral
12. What is the **best** description of the products expected from the following reaction?
- $$\text{(Z)-3-hexene} + \text{HCl} \rightarrow$$
- a single chiral compound
  - a single achiral compound
  - a pair of enantiomers
  - a mixture of diastereomers
  - a mixture of achiral isomers

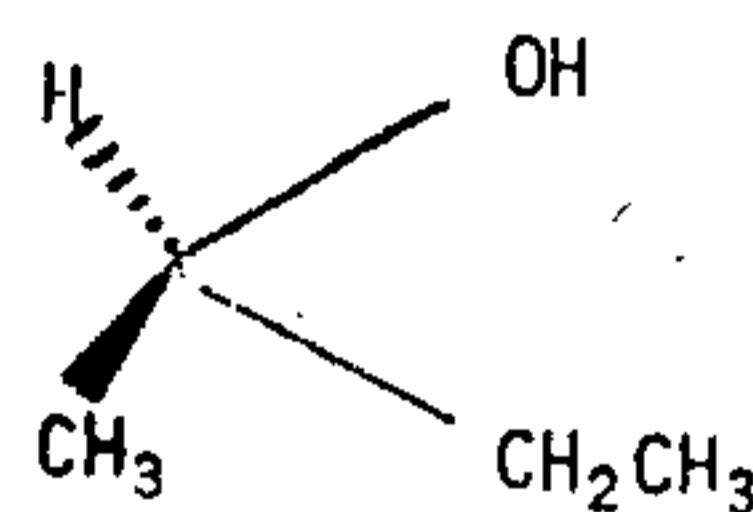
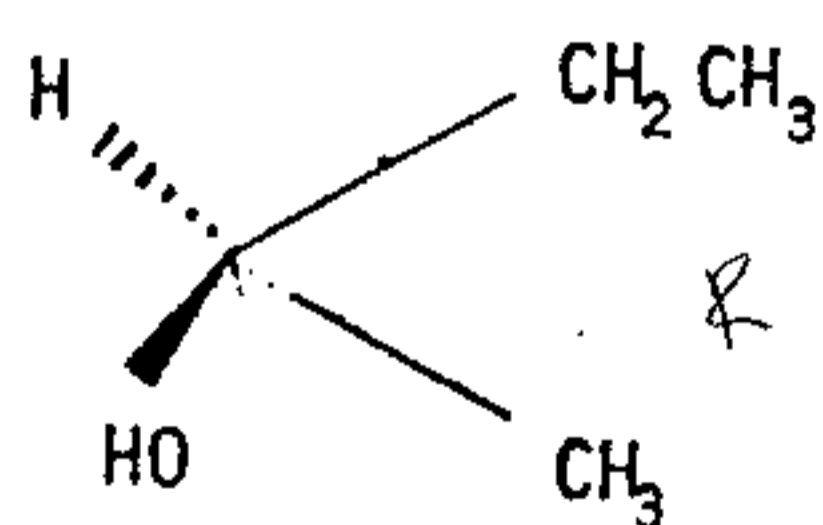
13. Both (E)- and (Z)-3-hexene can be treated with  $D_2$  (deuterium molecules) in the presence of a platinum catalyst. How are the products from these two reactions related to each other?

- a) The (E)- and (Z)-isomers generate the same products but in differing amounts.
- b) The (E)- and (Z)-isomers generate the same products in exactly the same amounts.
- c) The products of the two isomers are related as constitutional isomers.
- d) The products of the two isomers are related as stereoisomers.
- e) The products of the two isomers are not structurally related.

14. When 2-dibromobutane is heated at  $200\text{ }^\circ\text{C}$  in the presence of molten KOH, what is the **major** product?

- a) 1-bromo-1-butyne
- b) 1-bromo-2-butyne
- c) 1-butyne
- d) 2-butyne
- e) 1-butene

15. What is the **correct** relationship for the following pair of compounds?

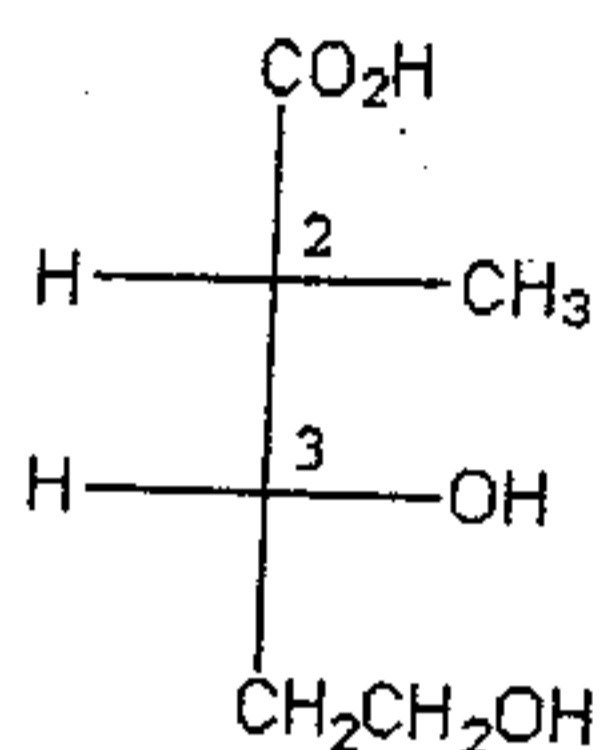


- a) enantiomers
- b) diastereoisomers
- c) meso
- d) structural isomers
- e) identical compound

16. When 2,2-dimethylbutane is subjected to free-radical chlorination, \_\_\_\_\_ distinct **monochlorinated** products are possible and \_\_\_\_\_ of these contain asymmetric carbon atoms.

- a) 4 ; 2
- b) 3 ; 1
- c) 3 ; 0
- d) 5 ; 2
- e) 4 ; 0

17. In the Fisher projection below, what are the configurations of the chirality centers?



- a) 2R, 3R
- b) 2R, 3S
- c) 2S, 3R
- d) 2S, 3S
- e) Absolute configurations cannot be done from Fisher projections when the compound has more than one chirality center.

18. How many distinct **terminal** alkynes exist with a molecular formula of  $\text{C}_5\text{H}_8$ ?

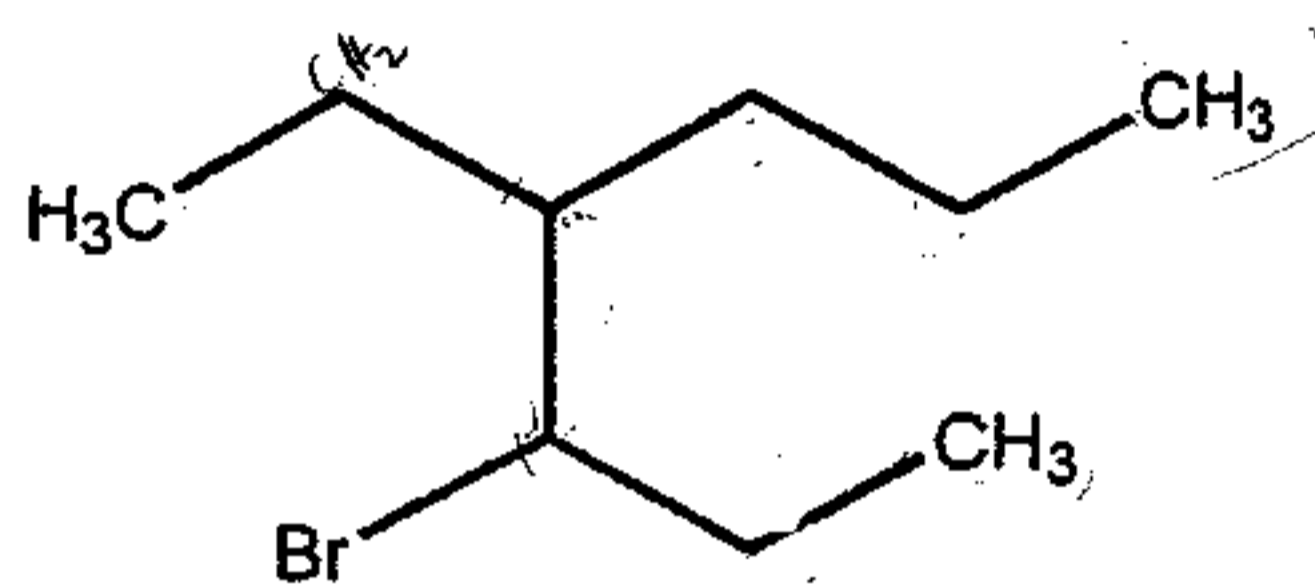
- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

19. Which of the following are optically inactive?

- I. a 50:50 mixture of R and S enantiomers
- II. a meso compound
- III. every achiral compound
- IV. a (total) racemic mixture

- a) I and IV only
- b) I, III and IV only
- c) I, II, and III only
- d) I and III only
- e) I, II, III, and IV

20. What is the correct **IUPAC** name for compound shown below?

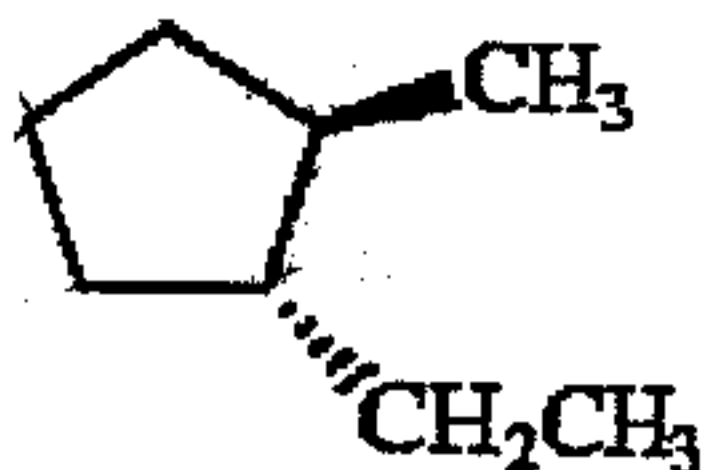


- a) 3-bromo-4-propylhexane
- b) 3-ethyl-4-bromoheptane
- c) 5-bromo-4-ethylheptane
- d) 4-ethyl-5-bromoheptane
- e) 3-bromo-4-ethylheptane

21. What is the product when one equivalent of HBr is added to 1-hexyne in the presence of peroxides?

- a) 2-bromo-1-hexene
- b) (E)-1-bromo-1-hexene
- c) (Z)-1-bromo-1-hexene
- d) a mixture of (E)- and (Z)-isomers of 1-bromo-1-hexene
- e) (E)-2-bromo-2-hexene

22. How many **asymmetric** carbon atoms are present in the following compound?



- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
23. Starting with 2-butene, which of the following is the **best** method for preparing 2-butyne?
- a) 1. HBr 2. H<sub>2</sub> / Ni 3. Zn / H<sup>+</sup>
- b) 1. HBr 2. Zn / H<sup>+</sup> 3. H<sub>2</sub> / Ni
- c) 1. Br<sub>2</sub> / CCl<sub>4</sub> 2. Zn / H<sup>+</sup> 3. H<sub>2</sub> / Ni
- d) 1. Br<sub>2</sub> / CCl<sub>4</sub> 2. KOH (fused)
- e) 1. HBr 2. NaNH<sub>2</sub>
24. Which of the following statements about designations of spatial relationships is **correct**?
- a) The designations R, S, E, and Z all specify conformations.
- b) The designations R, S, E, and Z all specify configurations.
- c) The designations R and S specify configurations, while E and Z specify conformations.
- d) The designations R and S specify conformations, while E and Z specify configurations.
- e) R and S, and E and Z can specify either configurations or conformations, depending on the class of compounds.
-

25. Which of the following is the **major** product from the reaction of N-bromosuccinimide with cyclopentene?

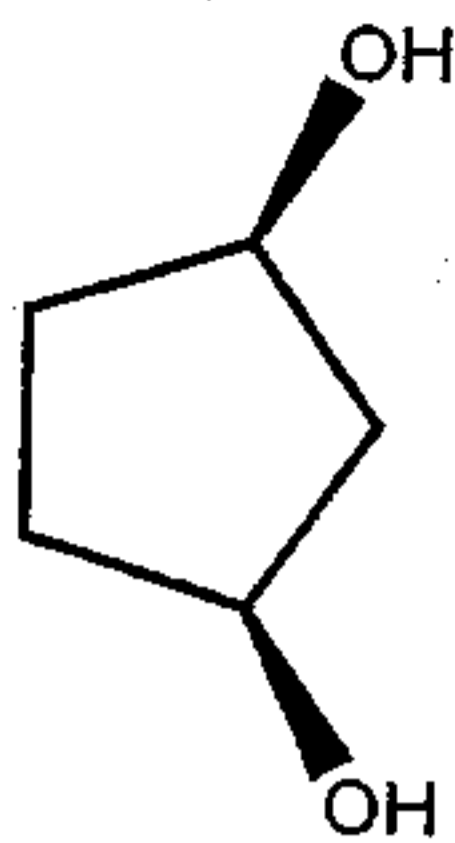
- a) bromocyclopentane
- b) 1-bromocyclopentene
- c) 2-bromocyclopentene
- d) 3-bromocyclopentene
- e) 1,2-dibromocyclopentane

26. What configurations are found in the products of the reaction shown below?



- a) 1R, 2R only
  - b) 1S, 2S only
  - c) 1R, 2S only
  - d) an equal mixture of 1R, 2R and 1S, 2S (threo enantiomers)
  - e) an equal mixture of 1S, 2R and 1R, 2S (erythro enantiomers)
27. When 2,6-dimethylheptane is chlorinated with chlorine and light, the **monochlorinated** product mixture will consist of:
- a) one primary alkyl chloride, one secondary alkyl chloride, and one tertiary alkyl chloride.
  - b) two primary and two secondary alkyl chlorides, but only one tertiary alkyl chloride.
  - c) two alkyl chlorides of each classification.
  - d) one primary and one tertiary alkyl chloride, but two secondary alkyl chlorides.
  - e) a different combination of isomers than any of the above.

28. How many **diastereomers** are there of the molecule shown below?



- a) 0  
b) 1  
c) 2  
d) 3  
~~e) 6~~
29. Which of the following reagents should be used to convert 3-hexyne to (E)-3-hexene?
- a)  $\text{H}_2$ , Pt  
b) Na,  $\text{NH}_3$   
c)  $\text{H}_2$ , Lindlar's catalyst  
d)  $\text{H}_2\text{SO}_4$ ,  $\text{H}_2\text{O}$   
e)  $\text{HgSO}_4$ ,  $\text{H}_2\text{O}$
30. Which of the following is **chiral**?
- a) cis-1-bromo-3-chlorocyclobutane  
b) trans-1-bromo-3-chlorocyclobutane  
c) cis-1,4-dimethylcyclohexane  
d) cis-1,3-dimethylcyclohexane  
e) trans-1,3-dimethylcyclohexane