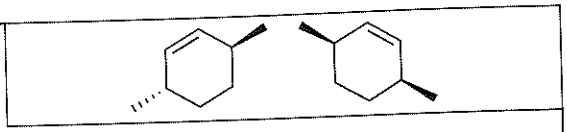
SQ-8. What is the stereochemical relationship between these compounds?



(A) constitutional isomers **(B)** conformational isomers

(C) enantiomers **(D)** diastereomers

Knowledge Required: (1) Definitions of constitutional isomers, conformational isomers, enantiomers, and diastereomers.

Thinking it Through: You are asked to determine the stereochemical relationships between two given compounds. Each answer choice is a different relationship.

You recall that constitutional isomers, choice **(A)**, have the same molecular formulas, but are not connected in the same way. You note that the two given compounds have the same molecular formula, but are connected in the same way, i.e., a six-membered ring that includes an alkene and has a methyl group at carbon-**3** and carbon-**6**.

You recall that conformational isomers, choice **(B)**, have the same molecular formula, are connected in the same absolute way, but differ in rotation of single bonds. You note that for the two given compounds, one methyl group differs in its absolute connectivity.

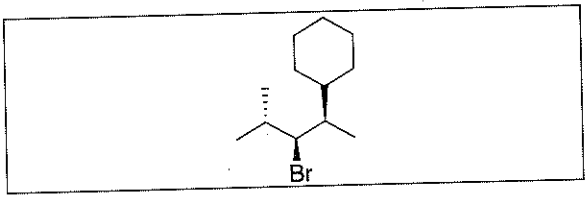
You recall that enantiomers, choice **(C)**, are non-superimposable, mirror-images of each other. You note that the two given compounds are not mirror images of each other.

You recall that diastereomers, choice **(D)**, are non-superimposable, non-mirror-images of each other. You note that the two given compounds match this definition. Therefore, choice **(D)** is the correct answer.

Practice Problems: **PQ-25, PQ-26, PQ-27, PQ-28, PQ-29** and **PQ-30**

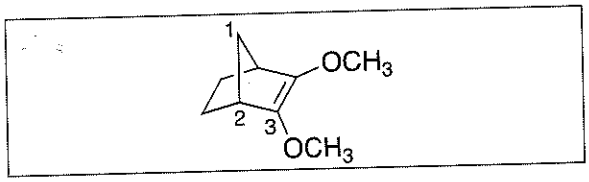
Practice Questions (PQ)

PQ-1. How many stereocenters are present in this molecule?



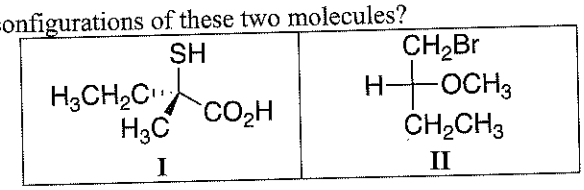
(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

PQ-2. Which of the numbered carbons in this compound are stereocenters?



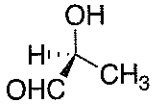
(A) 1, 2, and 3 **(B)** 1 and 3 **(C)** 2 only **(D)** 2 and 3

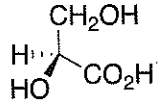
PQ-3. What are the absolute configurations of these two molecules?

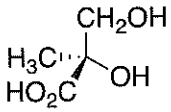


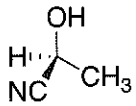
(A) **I**(*S*) and **II**(*S*) **(B)** **I**(*S*) and **II**(*R*) **(C)** **I**(*R*) and **II**(*S*) **(D)** **I**(*R*) and **II**(*R*)

PQ-4. Which molecule has the (*R*) configuration?

(A) 

(B) 

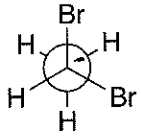
(C) 

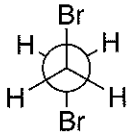
(D) 

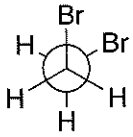
PQ-5. What is the molecular formula for an unsubstituted alkane of smallest molar mass which possesses a stereogenic center?

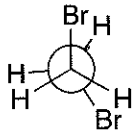
(A) C_5H_{12} **(B)** C_6H_{14} **(C)** C_7H_{16} **(D)** C_8H_{18}

PQ-6. Which Newman projection best depicts a gauche interaction between two bromine atoms?

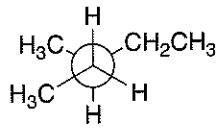
(A) 

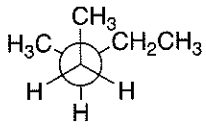
(B) 

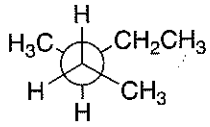
(C) 

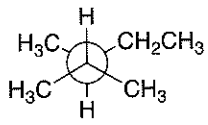
(D) 

PQ-7. Which Newman projection represents the most stable conformation of 3-methylpentane when viewed down the 2-3 carbon-carbon bond?

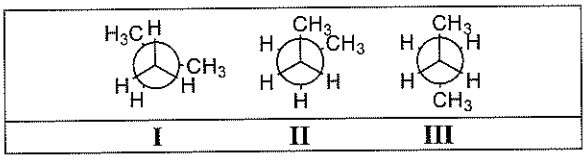
(A) 

(B) 

(C) 

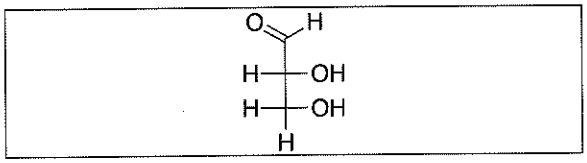
(D) 

PQ-8. Rank these conformations from least to most stable.



(A) **I < II < III** **(B)** **III < II < I** **(C)** **II < III < I** **(D)** **II < I < III**

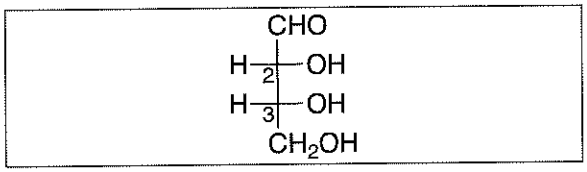
PQ-9. What is the name for this compound?



(A) (*S*)-1,2-dihydroxypropanal **(B)** (*R*)-2,3-dihydroxypropanal

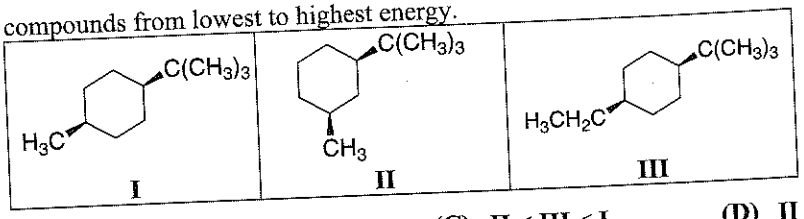
(C) (*S*)-2,3-dihydroxypropanal **(D)** (2*R*,3*R*)-2,3-dihydroxypropanal

PQ-10. What are the configurations of the two stereocenters in this Fischer projection?



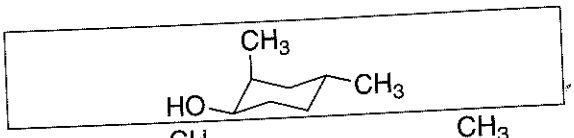
(A) 2*R*, 3*R* **(B)** 2*R*, 3*S* **(C)** 2*S*, 3*R* **(D)** 2*S*, 3*S*

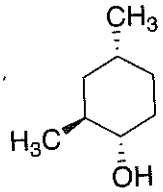
PQ-11. Rank these compounds from lowest to highest energy.

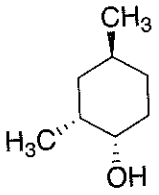


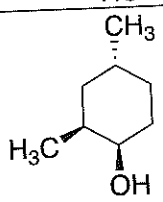
(A) I < II < III **(B)** III < II < I **(C)** II < III < I **(D)** II < I < III

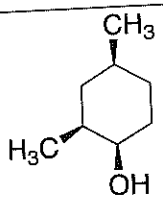
PQ-12. What structure is identical to this molecule?



(A)


(B)


(C)


(D)


PQ-13. What best describes the most stable conformation of *trans*-1-isopropyl-3-methylcyclohexane?

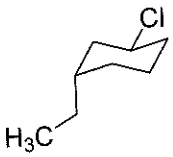
(A) The isopropyl group is equatorial, and the methyl group is axial.

(B) The isopropyl group is axial, and the methyl group is equatorial.

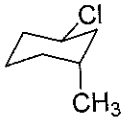
(C) Both the isopropyl and methyl groups are equatorial.

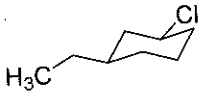
(D) Both the isopropyl and methyl groups are axial.

PQ-14. Which compound has the IUPAC name *trans*-1-chloro-3-ethylcyclohexane?

(A)


(B)


(C)


(D)


PQ-15. What factor is responsible for a greater heat of combustion per CH_2 for cyclopropane than the heat of combustion per CH_2 for cyclohexane.

(A) Cyclohexane has a different hydrogen-to-carbon atom ratio than cyclopropane.

(B) Cyclohexane has greater ring strain than cyclopropane.

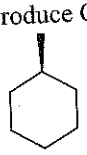
(C) Cyclopropane is a strained ring relative to cyclohexane.

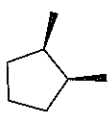
(D) Cyclohexane has more carbon atoms than cyclopropane.

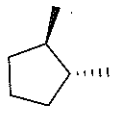
PQ-16. Which value is closest to the internal C–C–C bond angle in cyclohexane?

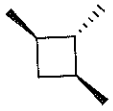
(A) 90° **(B)** 100° **(C)** 110° **(D)** 120°

PQ-17. Which molecules would have the highest heat of combustion, or release most energy when burned to produce CO_2 and H_2O?

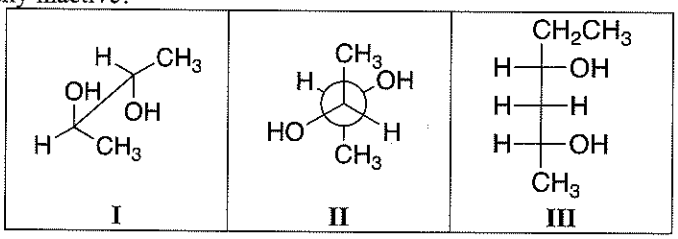
(A)


(B)


(C)


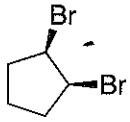
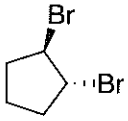
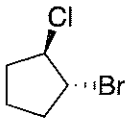
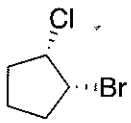
(D)


PQ-18. Which is/are optically inactive?

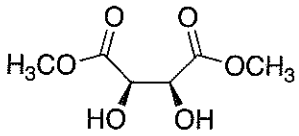
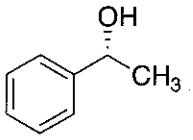


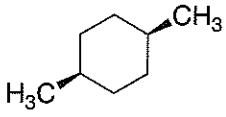
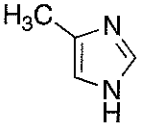
(A) **I** and **II** **(B)** **II** only **(C)** **III** only **(D)** **II** and **III**

PQ-19. Which molecule is NOT optically active?

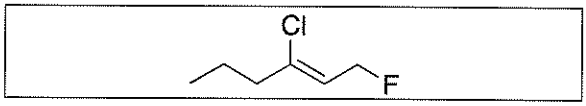
(A)  **(B)**  **(C)**  **(D)** 

PQ-20. Which compound is optically active?

(A)  **(B)** 

(C)  **(D)** 

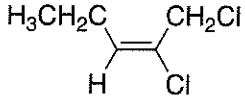
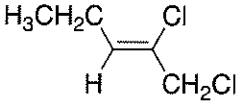
PQ-21. What is the IUPAC name for this compound?

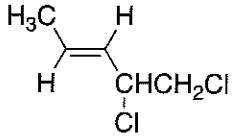
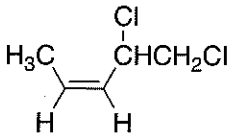


(A) (*Z*)-3-chloro-1-fluoro-2-hexene **(B)** (*E*)-3-chloro-1-fluoro-2-hexene

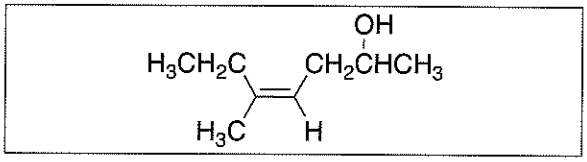
(C) (*Z*)-4-chloro-6-fluoro-4-hexene **(D)** (*E*)-4-chloro-6-fluoro-4-hexene

PQ-22. Which compound is (*E*)-1,2-dichloro-2-pentene?

(A)  **(B)** 

(C)  **(D)** 

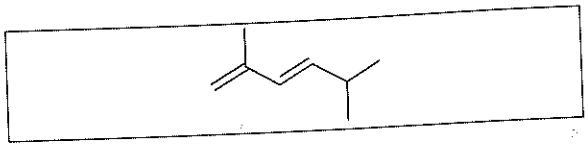
PQ-23. What is the IUPAC name for this compound?



(A) (*Z*)-5-ethyl-4-hexen-2-ol **(B)** (*Z*)-3-methyl-3-hepten-6-ol

(C) (*E*)-5-methyl-4-hepten-2-ol **(D)** (*Z*)-5-methyl-4-hepten-2-ol

PQ-24. What is the IUPAC name for this compound?



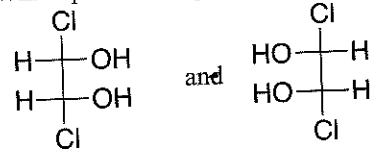
(A) (*E*)-2,5-dimethylhexa-1,3-diene

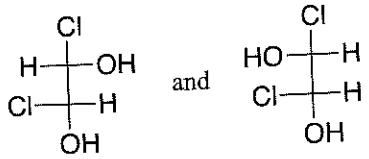
(B) (1*E*,3*E*)-2,5-dimethylhexa-1,3-diene

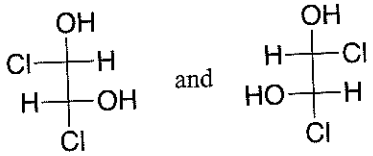
(C) (*Z*)-2,5-dimethylhexa-1,3-diene

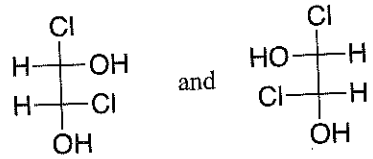
(D) (1*Z*,3*E*)-2,5-dimethylhexa-1,3-diene

PQ-25. Which pair of compounds are enantiomers?

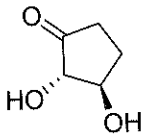
(A) 

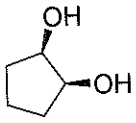
(B) 

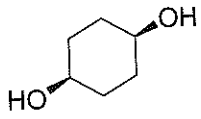
(C) 

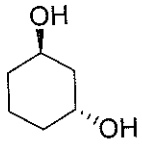
(D) 

PQ-26. Which structure represents a *meso* compound?

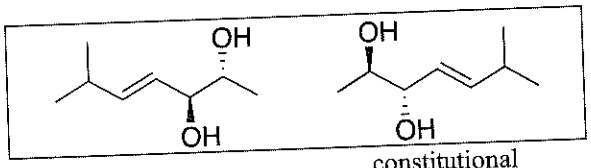
(A) 

(B) 

(C) 

(D) 

PQ-27. How are these molecules related?



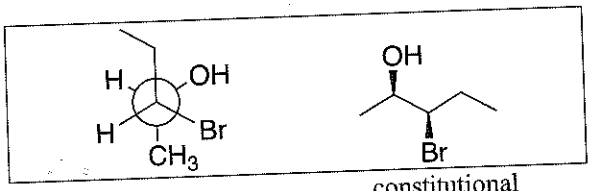
(A) identical

(B) enantiomers

(C) diastereomers

(D) constitutional isomers

PQ-28. How are these molecules related?



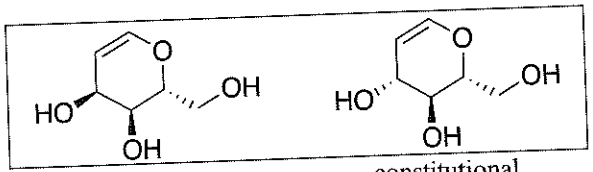
(A) identical

(B) diastereomers

(C) enantiomers

(D) constitutional isomers

PQ-29. How are these molecules related?



(A) identical

(B) diastereomers

(C) enantiomers

(D) constitutional isomers

PQ-30. What is the stereochemical classification of (1*S*,2*S*)-1,2-cyclohexanediol and (1*R*,2*S*)- 1,2-cyclohexanediol?

(A) enantiomers

(B) diastereomers

(C) meso compounds

(D) racemates