Key concepts you need to understand: Chirality and chiral centers; stereoisomers; (R,S) configurations at chiral centers and nomenclature; drawing 3D zig-zag structures; comparing structures (constitutional isomers, identical, different, conformers, geometric isomers, enantiomers, diastereomers, meso compounds); Fisher Projections; racemic mixtures.

Answers to Practice Problems can be found at the end of this document.

Practice Problems for Video CH 5-1:

(1) Which of the following molecules have a chiral carbon:
   A) I, II, III, IV and V
   B) I, II, III and IV
   C) I and II
   D) III and IV
   E) IV alone

(2) Enantiomers are:
   A) Any molecule that has a mirror image.
   B) Molecules that have one chiral center.
   C) Any non-superimposable molecules.
   D) Non-superimposable constitutional isomers.
   E) Non-superimposable molecules that are mirror images of each other.

(3) Cis-trans isomers are:
   A) geometric isomers.
   B) enantiomers.
   C) constitutional isomers.
   D) A and B

(4) Which of the following is the enantiomer of Compound A?
   A) I
   B) II
   C) III
   D) A does not have an enantiomer.
   E) Both II and III

(5) Hexane and 3-methylpentane are examples of:
   A) enantiomers.
   B) stereoisomers.
   C) conformers.
   D) constitutional isomers.
   E) None of these
(6) Which molecule has a plane of symmetry?
A) I
B) II
C) III
D) More than one of these
E) None of these

(7) An achiral molecule is one that is ________________ upon its mirror image.

(8) Enantiomers are stereoisomers whose molecules are ________________.

(9) A chiral molecule is defined as one that is ________________ on its mirror image.

Practice Problems for Video CH 5-2:

(1) (R)-2-Chlorobutane is represented by:
A) I and II
B) II and III
C) II and IV
D) V
E) None of the above

(2) Which structure represents (S)-2-bromobutane?
A) I
B) II
C) III
D) More than one of the above
E) None of the above

(3) The two compounds shown below are:
A) identical.
B) geometric (cis/trans) isomers.
C) constitutional isomers.
D) enantiomers.
E) different.

(4) Aspartame has how many chiral centers?

(5) When prioritizing groups on a chiral carbon, priority is based on ________________.
(6) An equal mixture of two enantiomers is called a ________________.

(7) Draw a zig-zag structure for \((2R,3S)\)-2-chloro-3-methylpentane

(8) Draw a zig-zag structure for \((2R,4S)\)-2,4-dibromo-2-chloropentane

(9) Draw a dash-wedge structure for \((1R,4R)\)-1,4-dibromo-1-chloro-1-fluoropentane

**Practice Problems for Video CH 5-3:**

(1) The two molecules drawn below are:
A) Constitutional isomers
B) Enantiomers
C) Identical
D) Diastereomers
E) Different

(2) Diastereomers are described by:
A) Two non-superimposable molecules that are mirror images of each other
B) Chiral, non-superimposable molecules that have different physical properties
C) Chiral molecules that have more than one chiral center
D) Both A and C
E) Both B and C

(3) Enantiomers have (identical or different) physical properties.

(4) Which of the following is NOT true of enantiomers? They have the same:
A) boiling point.
B) melting point.
C) chemical formula.
D) configuration.
E) None of the above

(5) The compounds whose molecules are shown below would have:
A) the same melting point.
B) different melting points.
C) same configuration.
D) More than one of the above
E) None of the above
(6) \( \text{CH}_3\text{CHBrCH}_2\text{CHClCH}_3 \) has a maximum of _________ stereoisomers?
A) 3  
B) 4  
C) 5  
D) 6  
E) 7

(7) The molecules below are:
A) constitutional isomers.  
B) enantiomers.  
C) diastereomers.  
D) identical.  
E) None of these

(8) I and II are:
A) constitutional isomers.  
B) enantiomers.  
C) identical.  
D) diastereomers.  
E) not isomeric.
Ans: A

(9) I and II are:
A) constitutional isomers.  
B) enantiomers.  
C) identical.  
D) diastereomers.  
E) different.
Ans: E

Practice Problems for Video CH 5-4:

(1) Which structure represents (R)-1-chloro-1-fluoroethane?
A) I  
B) II  
C) III  
D) More than one of the above  
E) None of the above

(2) I and II are:
A) constitutional isomers.  
B) enantiomers.  
C) identical.  
D) diastereomers.  
E) different.
(3) Looking at carbon-2, draw a Newman Projection for \((2R,3S)\)-2-bromo-3-chlorohexane:

\[
\begin{align*}
\text{Cl} & \quad \text{Br} \\
\end{align*}
\]

(4) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) not isomeric.

(5) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) not isomeric.

(6) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) not isomeric.

(7) What is the maximum number of stereoisomers for \(\text{CH}_3\text{CHFCHFCH(CH}_3\text{)}_2\)?
A) 1
B) 2
C) 3
D) 4
E) 8

**Practice Problems for Video CH 5-5:**

(1) In which Fisher Projection(s) are both chiral centers the (R) configuration?
A) I
B) II
C) III
D) More than one
E) None of these
(2) The molecules represented by these two Fisher Projections are:

A) enantiomers
B) diastereomers
C) constitutional isomers
D) different
E) identical

(3) How many chiral centers are there in Lovastatin?

A) 4
B) 5
C) 6
D) 7
E) 8

(Lovastatin)

(4) Which of the following represent a pair of enantiomers?

A) I, II and III, IV
B) I, II
C) III, IV
D) IV, V
E) None of the structures

(5) The molecules shown are:

A) constitutional isomers.
B) enantiomers.
C) diastereomers.
D) identical.
E) None of these

(6) The molecules shown are:

A) enantiomers.
B) diastereomers.
C) constitutional isomers.
D) two conformations of the same molecule.
E) different.
(7) Which of the compounds (I-IV) represent enantiomers?
A) I and II
B) II and III
C) III and IV
D) II and IV
E) III and IV

(8) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) not isomorphic.

(9) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) not isomeric.

(10) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) not isomeric.

Practice Problems for Video CH 5-6:

(1) Which of the following is a \textit{meso} compound?
A) I
B) II
C) III
D) IV
E) V
(2) Which of the following is (are) meso compound(s)?

A) I
B) II
C) III
D) Both II and III
E) Both I and III

(3) The molecules at the right are:
A) constitutional isomers.
B) enantiomers.
C) diastereomers.
D) identical.
E) None of these

(4) Which compound (I-IV) is a meso compound?

A) I
B) II
C) III
D) IV
E) None of these

(5) Which one of the following molecules is achiral?

A) (2R,3R)-2,3-Dichloropentane
B) (2R,3S)-2,3-Dichloropentane
C) (2S,4S)-2,4-Dichloropentane
D) (2S,4R)-2,4-Dichloropentane
E) Two of these

Ans: D

(6) Which is a meso compound?

A) (2R,3R)-2,3-Dibromobutane
B) (2R,4S)-2,4-Dibromopentane
C) (2R,4R)-2,4-Dibromopentane
D) (2R,3S)-2,3-Dibromopentane
E) (2R,4S)-2,4-Dibromohexane

(7) (2R,4S)-2,4-Dichloropentane and (2S,4R)-2,4-dichloropentane are:
A) enantiomers.
B) diastereomers.
C) identical.
D) conformational isomers.
E) constitutional isomers.
(8) A molecule that contains chiral carbons but is achiral is referred to as a ____________.

(9) A meso compound has _____ chiral center(s), and is ________ upon its mirror image.

**Practice Problems for Video CH 5-7:**

(1) The stereochemical relationship of cis/trans isomers of cyclic compounds are referred to as ________________.

(2) Which of the following is (are) meso?

A) I  
B) II  
C) III  
D) IV  
E) Two of the above

(3) How many unique dimethylcyclopropanes are there?

A) 2  
B) 3  
C) 4  
D) 5  
E) 6

(4) I and II are:

A) constitutional isomers.  
B) enantiomers.  
C) identical.  
D) diastereomers.  
E) not isomeric.

(5) I and II are:

A) constitutional isomers.  
B) enantiomers.  
C) identical.  
D) diastereomers.  
E) not isomorphic.

(6) Which statement is true of 1,3-dimethylcyclobutane?

A) Only one form of the compound is possible.  
B) Two diastereomeric forms are possible.  
C) Two sets of enantiomers are possible.  
D) Two enantiomeric forms and one meso compound are possible.  
E) None of the previous statements is true.
(7) The molecules below are:
A) constitutional isomers.
B) enantiomers.
C) diastereomers.
D) identical.
E) stereoisomers.

(8) The molecules shown are:
A) constitutional isomers.
B) enantiomers.
C) diastereomers.
D) identical.
E) different.

(9) The molecules below are:
A) constitutional isomers.
B) enantiomers.
C) diastereomers.
D) identical.
E) None of these

(10) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) not isomeric.

(11) The molecules below are:
A) constitutional isomers.
B) enantiomers.
C) diastereomers.
D) identical.
E) None of these

(12) I and II are:
A) constitutional isomers.
B) enantiomers.
C) identical.
D) diastereomers.
E) different.

Answers are on the next page
ANSWERS

CH 5-1 Answers (1-9): D, E, A, D, D, superimposable, nonsuperimposable mirror images, nonsuperimposable

CH 5-2 Answers (1-9):
C, A, D, two, atomic number, racemic mixture,

CH 5-3 Answers (1-9): D, E, identical, D, D, B, D, A, E

CH 5-4 Answers (1-7): C, A, B, C, D, D

CH 5-5 Answers (1-10): B, B, E, C, B, B, D, D, B

CH 5-6 Answers (1-9): A, E, A, D, D, B, C, meso compound, two/superimposable

CH 5-7 Answers (1-12): diastereomers, D, C, D, D, B, A, E, A, C, B, D