1. **Which of the following best describes the isomer relationship between cis-1,2-dichlorocyclopropane and trans-1,2-dichlorocyclopropane?**
   a) Enantiomers
   b) Diastereomers
   c) Constitutional isomers
   d) Identical

2. **A molecule with the molecular formula C_4H_8 that has a cis-trans isomerism must be:**
   a) An alkane
   b) A cycloalkane or an alkene
   c) An alkyne
   d) An alcohol

3. **Assigning R/S configuration to a chiral center with the hydrogen atom pointing towards you requires:**
   a) Directly assigning the priority
   b) Reversing the final assignment (if R, call it S)
   c) Imagining the molecule from the other side
   d) It is impossible to assign

4. **Which compound is a meso form?**
   a) 1,2-dichloropropane
   b) 2,3-dichlorobutane
   c) 1,3-dichlorobutane
   d) 1,4-dichlorobutane

5. **The terms "erythro" and "threo" are traditionally used to describe:**
   a) Enantiomers
   b) Diastereomers with two chiral centers
   c) Conformers
   d) Meso compounds

6. **A molecule that is not superimposable on its mirror image is called:**
   a) Achiral
   b) Chiral
   c) Meso
   d) Symmetrical

7. **In a Fischer projection, horizontal lines represent bonds:**
   a) bonds going away from the
   b) bonds coming toward the viewer
   c) In the plane of the paper
   d) That are rotating freely

8. **The process by which a pure enantiomer is converted into a racemic mixture is called:**
   a) Resolution
   b) Racemization
   c) Inversion
   d) Desymmetrization

9. **Which of the following statements about enantiomers is FALSE?**
   a) They have the same melting point.
   b) They have the same boiling point.
   c) They rotate plane-polarized light to the same extent but in opposite directions.
   d) They interact identically with other chiral molecules.

10. **For a molecule with the formula C_6H_{12} that has no rings or double bonds, how many stereoisomers are possible if it contains one chiral center?**
    a) 1
    b) 2
    c) 3
    d) 4

11. **The specific rotation of a pure (+)-enantiomer is +40°. What is the percentage composition and observed rotation of a mixture with an observed specific rotation of +20°?**
    a) 75% (+), 25% (-); +20°
    b) 50% (+), 50% (-); 0°
    c) 25% (+), 75% (-); -20°
    d) 100% (+); +40°

12. **Which of the following statements about a meso compound is INCORRECT?**
    a) It has a plane of symmetry.
    b) It is optically inactive.
    c) It has no chiral centers.
    d) It is achiral.

13. **The conversion of (R)-2-bromobutane to (S)-2-bromobutane involves:**
    a) Racemization
    b) Inversion of configuration
    c) Retention of configuration
    d) Diastereomerization

14. **Which of the following molecules will exhibit optical activity?**
    a) Glyceraldehyde
    b) *meso*-Tartaric acid
    c) 1,1'-Bi-2-naphthol (BINOL)
    d) *cis*-1,2-Dimethylcyclohexane

15. **A molecule with 4 different chiral centers will have a maximum of how many stereoisomers?**
    a) 4
    b) 8
    c) 16
    d) 32

16. **The separation of a racemic mixture into its enantiomers is known as:**
    a) Resolution
    b) Racemization
    c) Regioselectivity
    d) Distillation

17. **Which descriptor is used for the configuration of chiral centers in carbohydrates and amino acids?**
    a) R/S
    b) D/L
    c) E/Z
    d) Cis/Trans

18. **A molecule that lacks a plane of symmetry and a center of symmetry is:**
    a) Definitely chiral
    b) Definitely achiral
    c) Possibly chiral
    d) A meso compound

19. **The stereochemical outcome of an SN1 reaction at a chiral center is:**
    a) Complete inversion
    b) Complete retention
    c) Racemization
    d) Diastereoselectivity

20. **Which of the following is an example of axial chirality?**
    a) Lactic acid
    b) Alanine
    c) Allene ($H_2C=C=CH_2$ with substituted ends)
    d) *meso*-2,3-Butanediol

21. **The Cahn-Ingold-Prelog priority for the following groups is:**
    $-CH_2Br$
    $-CH_2Cl$
    $-CH_2F$
    $-CH_3$
    a) $-CH_2Br > -CH_2Cl > -CH_2F > -CH_3$
    b) $-CH_3 > -CH_2F > -CH_2Cl > -CH_2Br$

c) $-CH_2Br > -CH_2F > -CH_2Cl > -CH_3$
d) $-CH_2Cl > -CH_2Br > -CH_2F > -CH_3$

22. **If a molecule has an S_4 improper rotation axis, it is:**
    a) Chiral
    b) Achiral
    c) Optically active
    d) A meso compound

23. **The terms "syn" and "anti" are often used to describe the stereochemistry of:**
    a) Aldol addition products
    b) Epoxidation products
    c) Molecules with two chiral centers
    d) All of the above

24. **A sample with an enantiomeric excess (ee) of 80% of the (-)-enantiomer means the mixture contains:**
    a) 80% (-) and 20% (+)
    b) 90% (-) and 10% (+)
    c) 80% racemic mixture and 20% (-)
    d) 20% (-) and 80% racemic

25. **Which of the following is true for diastereomers?**
    a) They have identical chemical properties in all environments.
    b) They have the same specific rotation.
    c) They have different physical properties.
    d) They are mirror images.

26. **The number of stereoisomers for 1,2-dimethylcyclopropane is:**
    a) 2
    b) 3
    c) 4
    d) 0

27. **A chiral molecule must belong to which point group?**
    a) A point group containing a plane of symmetry (σ)
    b) A point group containing an inversion center (i)
    c) A point group containing an improper axis (S_n)
    d) A point group containing only proper rotation axes (C_n)

28. **A reaction that produces a single stereoisomer from an achiral starting material, without the influence of a chiral agent, is:**
    a) A stereospecific reaction
    b) A stereoselective reaction

c) An enantioselective reaction
d) An impossible reaction

29. **In the Fischer projection of a D-sugar, the hydroxyl group on the chiral center farthest from the carbonyl group is:**
    a) On the left
    b) On the right
    c) Undefined
    d) Always equatorial

30. **The phenomenon where a molecule exists in two stereoisomeric forms that can interconvert by rotation about a single bond, but the barrier to rotation is high enough to allow isolation of the isomers, is called:**
    a) Conformational isomerism
    b) Atropisomerism
    c) Tautomerism
    d) Ring-flip isomerism

31. **A molecule with the point group C_2 is:**
    a) Achiral
    b) Chiral
    c) A meso compound
    d) Optically inactive

32. **. Which of the following techniques is most commonly used to determine the enantiomeric purity of a sample?**
    a) Infrared (IR) Spectroscopy
    b) Nuclear Magnetic Resonance (NMR) with a chiral solvent/chiral shift reagent
    c) Mass Spectrometry (MS)
    d) Ultraviolet-Visible (UV-Vis) Spectroscopy

33. **The process where a substrate reacts with different stereoisomers of a reagent at different rates is an example of:**
    a) Steric hindrance
    b) Stereoelectronic effects
    c) Diastereoselectivity
    d) Regioselectivity

34. **The descriptor for the stereochemistry of a trigonal bipyramidal molecule with five different substituents is based on:**
    a) R/S nomenclature
    b) E/Z nomenclature
    c) The Berry pseudorotation
    d) The apical-equatorial priority

35. **The product of a syn addition of osmium tetroxide (OsO_4) to a *cis*-alkene is:**
    a) A meso compound
    b) A pair of enantiomers
    c) A pair of diastereomers
    d) An achiral molecule

36. **A molecule that is chiral due to its overall molecular shape (helical structure), rather than a chiral center, exemplifies:**
    a) Central Chirality
    b) Axial Chirality
    c) Planar Chirality
    d) Helical Chirality

37. **The stereochemical outcome of a hydroboration-oxidation reaction on an achiral alkene is:**
    a) A single enantiomer
    b) A racemic mixture
    c) A meso compound
    d) A diastereomeric mixture

38. **The term "epimer" refers to:**
    a) Enantiomers that differ at every chiral center
    b) Diastereomers that differ in configuration at exactly one chiral center
    c) A special type of meso compound
    d) Stereoisomers of epoxides

39. **Which of the following is the best method for determining the absolute configuration of a chiral molecule?**
    a) Boiling Point Determination
    b) Polarimetry
    c) X-ray Crystallography
    d) Refractive Index Measurement

40. **. A molecule with two stereogenic centers, one of which is pseudoasymmetric, has how many stereoisomers?**
    a) 2
    b) 3
    c) 4
    d) 5