

# Revision Questions

## Very Short Answer Type Questions

1. Define the following terms :

(i) Isomerism

(ii) Structural isomerism.

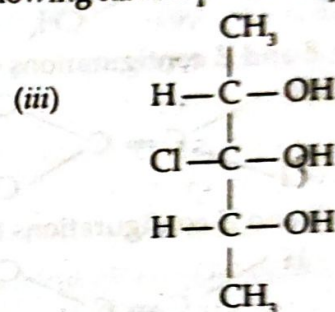
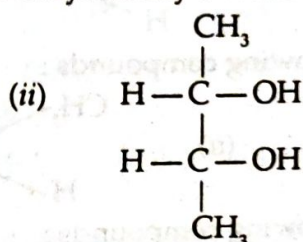
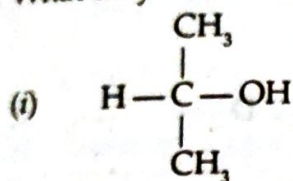
2. What is meant by stereoisomerism ? How does it differ from structural isomerism ?

3. Explain the following terms :

(i) Plane polarised light

(ii) Optical activity.

4. What do you understand by plane of symmetry ? Which of the following have a plane of symmetry ?



5. Define the following terms :

(i) Axis of symmetry

(ii) Centre of symmetry.

6. Explain the necessary and sufficient condition of optical activity.

7. Explain the term meso form with suitable example.

8. What is functional isomerism ? Illustrate with one example.

9. Explain the essential difference between diastereomers and enantiomers.

10. What is meant by hindered rotation ? What kind of isomerism does it lead to ?

11. What do you understand by the term conformations ? What is it due to ?

12. How many conformations of ethane are possible ? Name and draw two of these conformations in terms of sawhorse formulae.

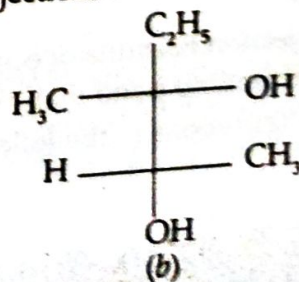
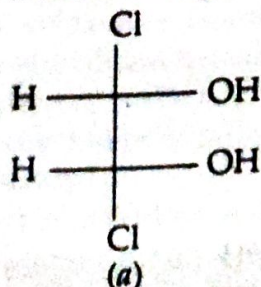
13. What is meant by tetrahedral nature of carbon ? How can you represent it on paper ?

14. How will you prepare (-) Lactic acid from Pyruvic acid ?

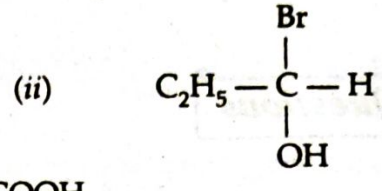
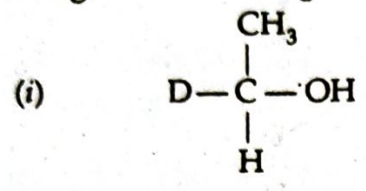
15. What is meant by stereogenic centre ? Illustrate your answer with a suitable example.

16. Draw the Fischer formula of (a) an achiral molecule having only one carbon atom (b) an achiral molecule with two stereogenic centres.

17. Assign R and S configuration to the following Fischer projections :

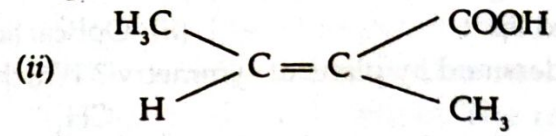
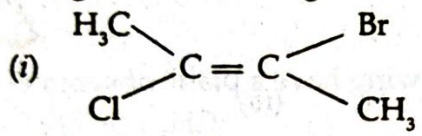


18. Assign E and Z configurations to the following :  
 (i) Maleic acid (ii) trans-But-2-enoic acid
19. Draw the structure of chair form of cyclohexane depicting the axial and equatorial bonds.
20. A carboxylic acid of the formula  $C_3H_5O_2Br$  is optically active? What is its structure?
21. With suitable examples explain the terms : (i) Axial hydrogen atoms (ii) Flagpole hydrogen atoms.
22. Explain the term torsional strain.
23. Explain why chair form of cyclohexane is more stable than boat form.
24. Assign R and S configurations to the following :

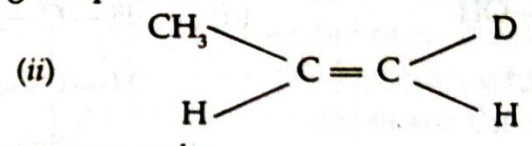
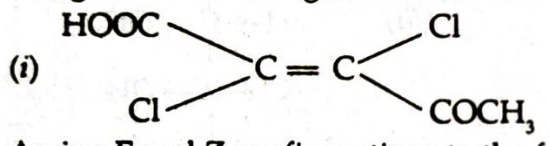


25. Write down the configurations of  $\begin{array}{c} CHCOOH \\ || \\ CHCOOH \end{array}$  according to E and Z sequence rules.

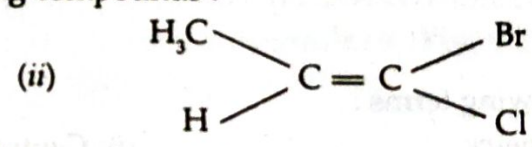
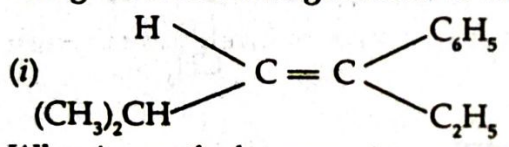
26. Assign E and Z configurations to the following :



27. Assign E and Z configurations to the following compounds :



28. Assign E and Z configurations to the following compounds :



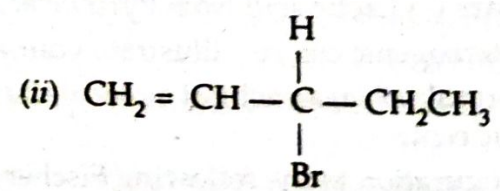
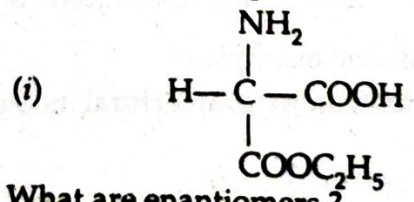
29. Why is methyl group in equatorial position of cyclohexane more stable than in the axial position? (K.U. 2000)
30. What is meant by the term Resolution? (M.D.U. 2000)
31. Write the functional isomers of acetone and methyl formate. (G.N.D.U. 2000)
32. Fill in the blanks : (K.U. 2001)

- (i) Preparation of chiral molecule from an achiral molecule is called .....
- (ii) ..... is the necessary condition for optical isomerism to exist. (M.D.U. 2001)

33. Which conformer of ethane has maximum energy : (G.N.D.U. 2001)

- (a) Skew (b) Eclipsed (c) Staggered (d) All have equal energy.

34. Assign R, S configurations to the following compounds :

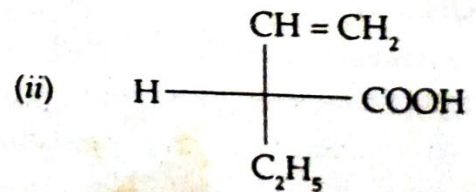
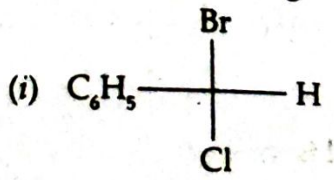


35. What are enantiomers?

36. Write Newman Projection Formula of eclipsed conformation of ethane.

37. cis-alkene has higher boiling point than trans-alkene. Why?

38. Assign R and S configurations to the following :



(H.P.U. 2001)  
 (P.U. 2001)  
 (P.U. 2001)  
 (P.U. 2001)

(Pbi. U. 2002)

39. With suitable example, explain :

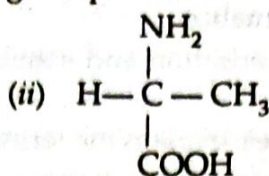
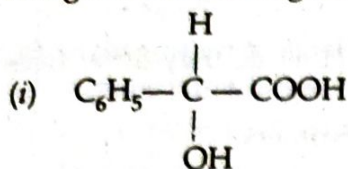
(i) Axial H-atoms

(ii) Flag pole H-atoms.

(Pbi. U. 2002)

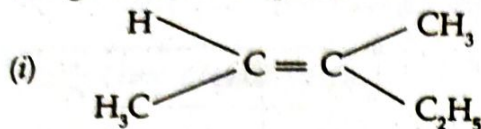
40. Assign R and S configurations to the following compounds :

(H.P.U. 2003)

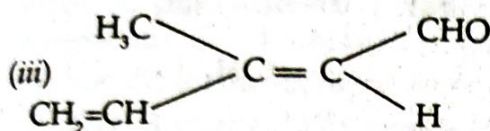
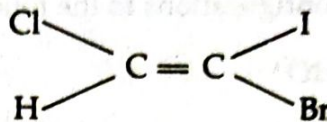


41. Assign E or Z configurations to the following :

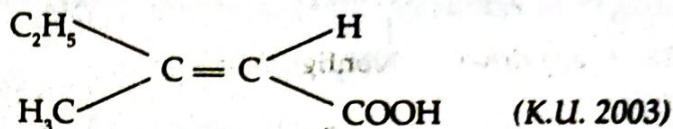
(K.U. 2003)



(ii)



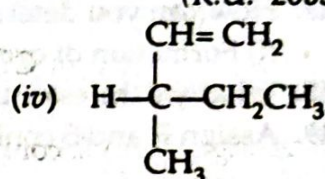
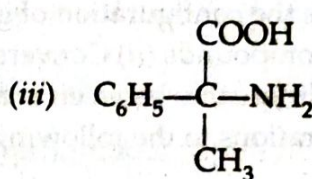
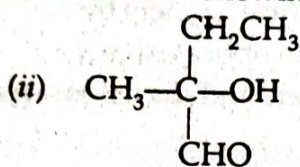
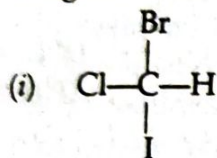
(iv)



(K.U. 2003)

(K.U. 2003)

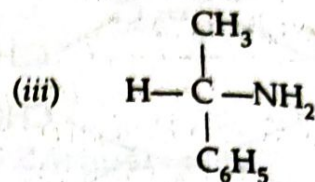
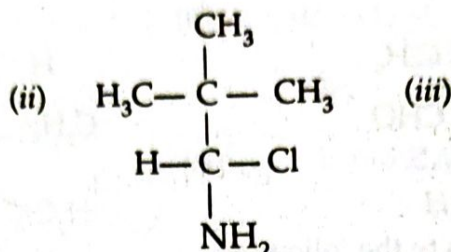
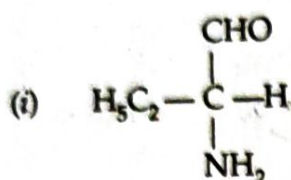
42. Assign R and S configurations to the following :



### Short Answer Type Questions

- Explain the following terms :  
(i) Polarised light (ii) Optical activity (iii) Specific rotation.
- What do you understand by stereogenic centre ? How does it lead to the phenomenon of enantiomerism ?
- Explain the terms :  
(i) Enantiomers (ii) Diastereomers, and (iii) Meso compounds.
- Name the various methods used for resolution of racemic modifications. Describe one of the methods in detail.
- Explain the following terms :  
(i) Configurational isomers (ii) Geometric isomers.
- What do you understand by hindered rotation around double bond ? What type of isomerism does it lead to ? Explain with suitable examples.
- Describe the methods for distinguishing between *cis*- and *trans*-isomers.
- What is the difference between the terms "conformation" and "configuration" ? Illustrate your answer by choosing one suitable example of each.
- Give the salient features of chair and boat conformations of cyclohexane.
- There is no strain in either the chair or boat forms of cyclohexane. Why then the chair conformation is more stable and preferred than the boat conformation ?
- Write a short note on equatorial and axial bonds in cyclohexane.
- Give three sequence rules which are used to assign priorities to atoms or groups. Illustrate each rule with at least two examples.
- How will you convert racemic lactic acid into optically active forms ? Give two methods.
- Write a short note on isomerism exhibited by maleic and fumaric acids.
- How can you obtain the configuration of geometrical isomers by :  
(i) Formation of cyclic compounds (ii) Dipole moment (iii) Conversion of optical isomers
- Give stereoisomers of tartaric acid. How do you account for the lack of optical activity in its meso and racemic forms ?
- Explain what is Walden's inversion ?
- What is resolution ? Give two methods used for this purpose with examples.
- What are the factors which contribute towards the stability of conformational isomers ?

20. Sketch Newman's projection formulae for important conformations of *n*-butane (with reference to its central C — C bond). Arrange them in order of increasing stability (Give reason).
21. Discuss the relative stabilities of chair and boat conformations of cyclohexane.
22. In terms of eclipsing interactions explain why chair and twist boat conformations of cyclohexane are more stable than the boat conformation.
23. What is meant by internal compensation and external compensation? How do they differ from each other?
24. With the help of suitable examples, explain the terms threo and erythro isomers.
25. Discuss how geometrical isomerism affects melting and boiling points.
26. Assign R and S configurations to the following compounds:

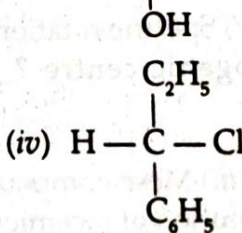
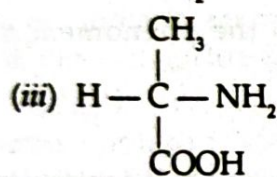
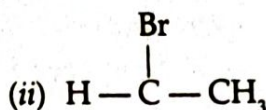
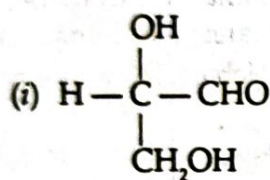


27. How can you determine the configuration of geometrical isomers by :  
 (i) Formation of cyclic compounds (ii) Conversion into optical isomers.
28. What are the essential differences between enantiomers and diastereomers?
29. Assign R and S configurations to the following:

(M.D.U. 2000)

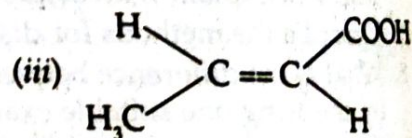
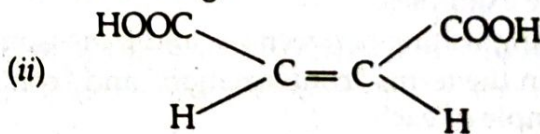
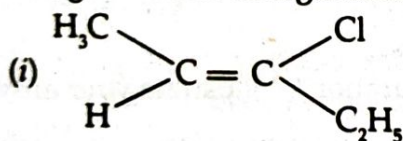
(K.U. 2001)

(P.U. 2001)



(K.U. 2001)

30. Explain the statement, "Walden inversion does not necessarily mean optical inversion". (M.D.U. 2001)
31. What do you understand by chair and boat conformations? Why is chair conformation of cyclohexane more stable than boat conformation?
32. Assign E and Z configurations to the following:

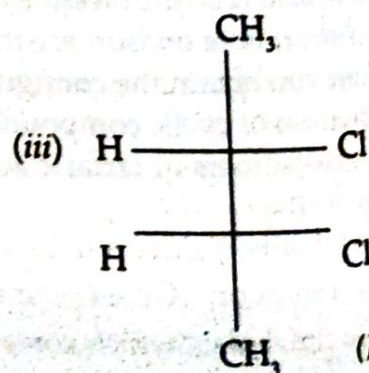
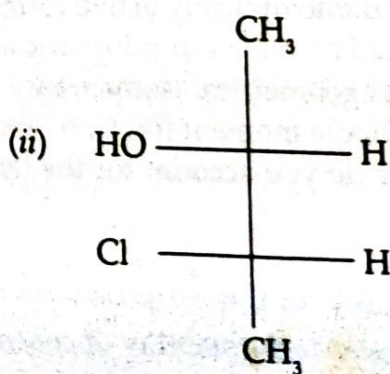
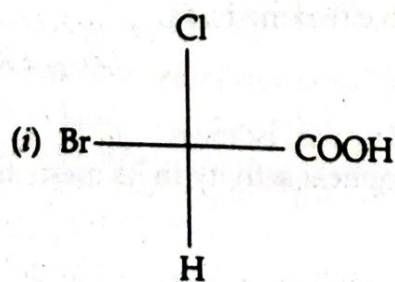


(M.D.U. 2002)

33. Taking suitable examples write different rules followed to assign R and S configurations.

(G.N.D.U. 2002)

34. (a) Distinguish between Meso and Racemic forms  
 (b) Assign R and S configurations to the following:



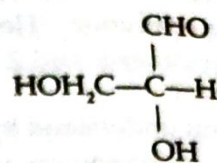
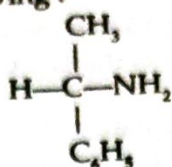
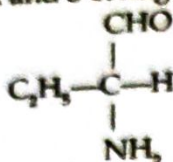
(P. U. 2002)

35. (a) Draw various conformations of *n*-butane and represent them on potential energy diagram.  
(b) What is resolution? How will you resolve a racemic mixture by chemical method? (Pb. U. 2002)
36. What do symbols E and Z stand for? What is the advantage of using those over the conventional *cis-trans* system? (Pb. U. 2003)
37. What do you understand by conformers? Explain. (G.N.D.U. 2003)
38. How many stereoisomers are possible for 2, 3-dichlorobutane? Write their configurations. (K.U. 2003)
39. Write a note on conformations of ethane. (K.U. 2003)
40. (a) Explain dissymmetry is an essential condition for optical activity.  
(b) Give the characters of enantiomers. (M.D.U. 2003)

**Descriptive Questions**

1. What do you understand by the term isomerism? Name different types of isomerism in organic compounds. Give at least one example of each.
2. Explain the following terms with two examples of each :  
(i) Chiral structure (ii) Enantiomers (iii) Diastereomers (iv) Meso compounds.
3. Give an account of the isomerism exhibited by lactic acid. What is meant by resolution? Describe at least two methods for resolving racemic compounds.
4. Explain what do you understand by Rectus and Sinister system of designation of chiral centres. Describe the procedure adopted in detail.
5. Write a note on geometrical isomerism and state any three methods by which geometrical isomers can be distinguished from each other. Give your answer with particular reference to maleic and fumaric acids.
6. Write down the *cis*- and *trans*- forms for those of the following compounds which can show geometric isomerism :  
(i) 2-Butene (ii) 1, 1-Dibromo-1-butene (iii) 2-Pentene (iv) 1, 2-Dichloro-1-propene.
7. What do you understand by conformations? Discuss the various conformations of *n*-butane with reference to central carbon-carbon bonds? Arrange the main conformations in order of relative stabilities.
8. Briefly discuss the various factors which affect the stability of conformations.
9. Draw the Newman projection formulae and usual formulae of the two important conformations of cyclohexane. Discuss the energy relationship between the various possible conformations of this compound.
10. What is meant by optical activity? Draw the Fischer projection formulae of various stereoisomers of tartaric acid. Why is one of the isomers optically inactive?
11. What do you understand by Rectus and Sinister system of designation of chiral centres? State and illustrate the sequence rules.
12. State and explain the necessary and sufficient conditions for a compound to show geometrical isomerism. Give any two methods by which geometrical isomers can be distinguished.
13. What do the symbols E and Z stand for? Illustrate briefly the E and Z system of naming a pair of geometrical isomers. What are the advantages of E - Z system over the conventional *cis-trans* system? (K.U. 2000)
14. What is isomerism? Give its complete classification. (P.U. 2001)
15. Write the conformations of *n*-butane and discuss their relative stabilities. (G.N.D.U. 2001)
16. Discuss in detail with examples, the priority rules for assigning :  
(a) R and S configurations (b) Z and E notations. (P. U. 2002)
17. What do you understand by the term "conformation"? Explain stabilities of chair and boat conformations of cyclohexane. (Pb. U. 2002)
18. Give four configurations of tartaric acid and select the pairs forming :  
(i) Enantiomers (ii) Diastereomers. (H.P.U. 2003)
19. Define optical activity. Give the stereoisomers of tartaric acid. How do you explain the lack of optical activity in mesotartaric acid? (K.U. 2003)
20. Explain the difference between meso form and racemic form by taking suitable examples. (K.U. 2003)
21. Distinguish between enantiomers and diastereomers with suitable examples. (K.U. 2003)

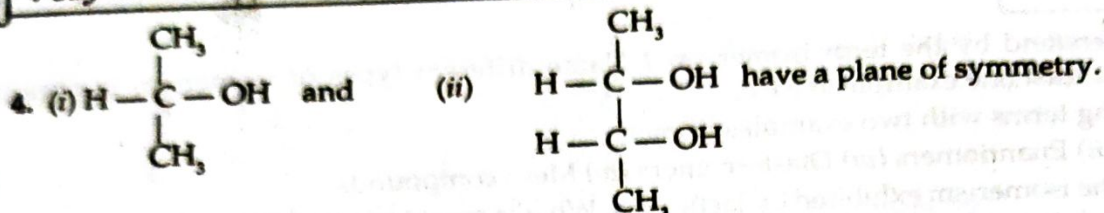
22. Give R and S configuration for the following :



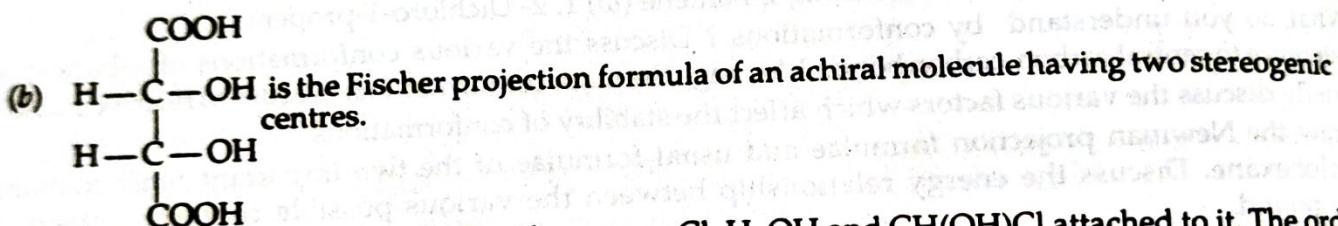
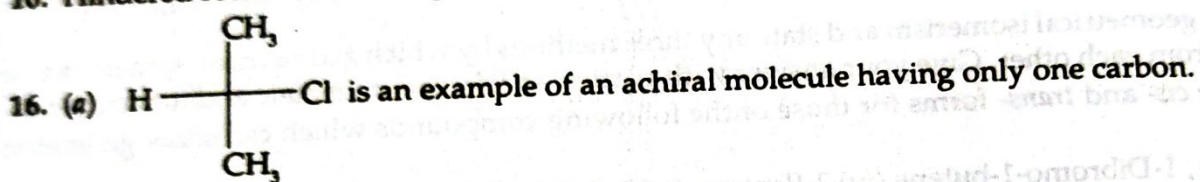
(M.D.U. 2003)

## HINTS & ANSWERS TO SELECTED QUESTIONS

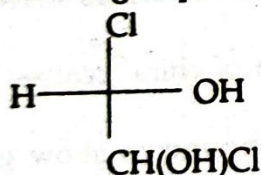
### Very Short Answer Type Questions



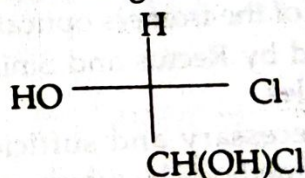
6. The necessary and sufficient condition of optical activity is chirality of the structure.  
10. Hindered rotation leads to geometrical isomerism.



17. (a) Each of carbon atoms 1 and 2 has the groups Cl, H, OH and CH(OH)Cl attached to it. The order of priorities of groups is Cl, OH, CH(OH)Cl and H. The configuration at  $^1\text{C}$  is assigned as follows :

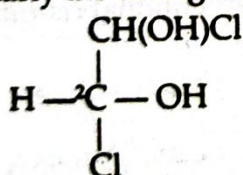


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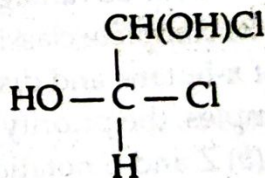


Configuration = S

Similarly the configuration at  $^2\text{C}$  is assigned as follows :

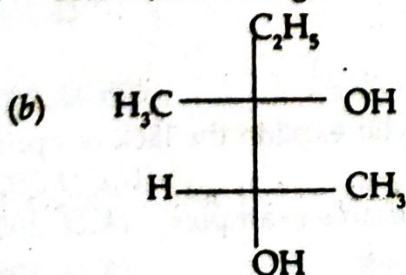


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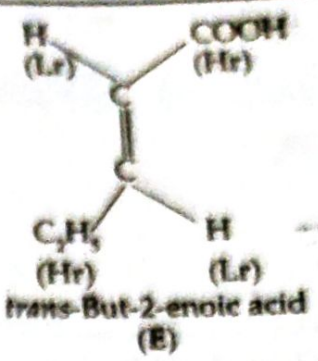
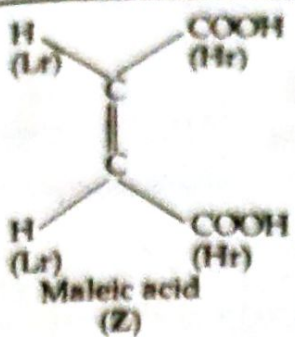
Configuration = R.

Hence, the configuration of this compound is 1S, 2R.

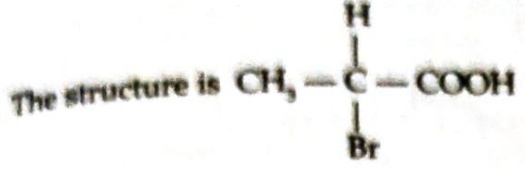


The configuration is 1S, 2R.

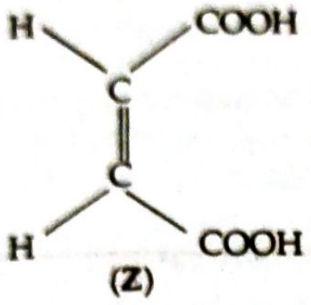
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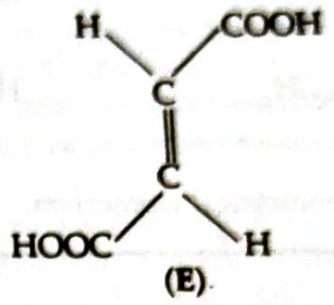
20.



24. (i) = R

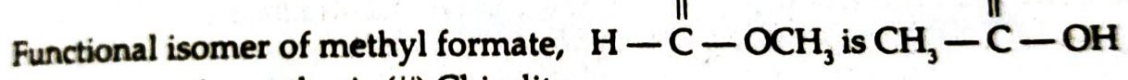
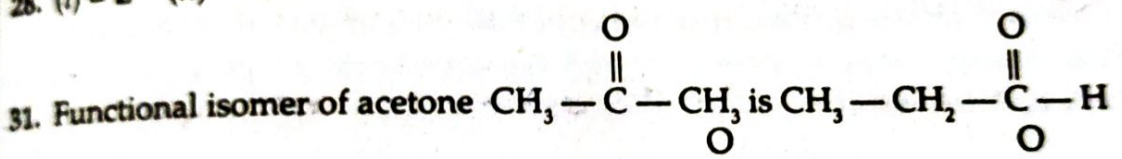


(ii) = S



25.

26. (i) = E (ii) = Z  
 27. (i) = E (ii) = Z  
 28. (i) = E (ii) = Z



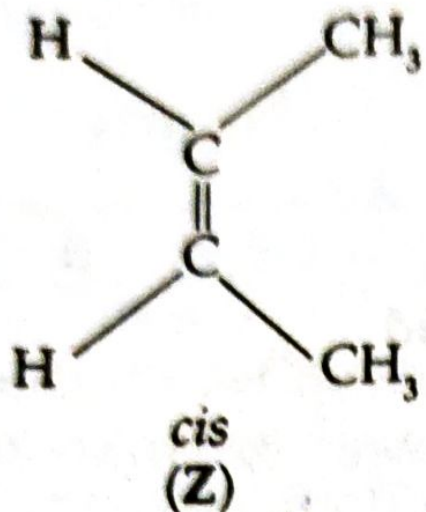
32. (i) Asymmetric synthesis (ii) Chirality  
 33. (b) Eclipsed  
 34. (i) Configuration is S (Make two exchanges)  
 (ii) Configuration is R  
 38. (i) Configuration is S (ii) Configuration is R (Make two exchanges in each case).

**Short Answer Type Questions**

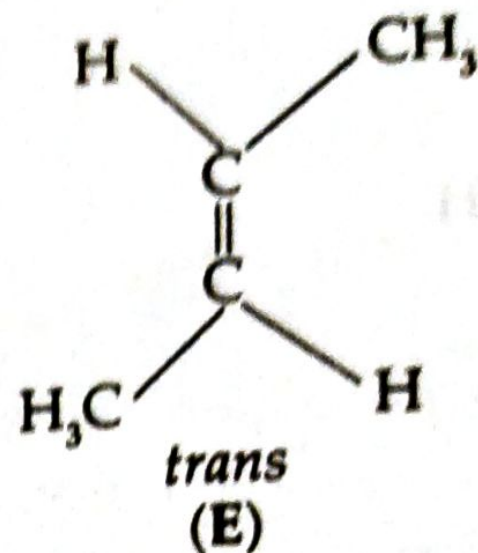
26. (i) Configuration is R  
 (ii) The groups attached to chiral carbon atom are NH<sub>2</sub>, H, Cl and (CH<sub>3</sub>)<sub>3</sub>C. Configuration is S  
 (iii) Configuration is S (Make two exchanges in each case)  
 29. (i) S (ii) R (iii) S (iv) S (Two exchanges are required in each case)  
 32. (i) = Z (ii) = Z (iii) = E  
 34. (i) = R  
 (ii) 2R, 3S  
 (The groups attached to <sup>2</sup>C in the order of priority are : -OH, -CHCl-CH<sub>2</sub>, -CH<sub>3</sub> and H. Similarly for <sup>3</sup>C, the groups are : -Cl, -CHOHCH<sub>2</sub>, -CH<sub>3</sub> and H)  
 (iii) 2S, 3R

## Descriptive Questions

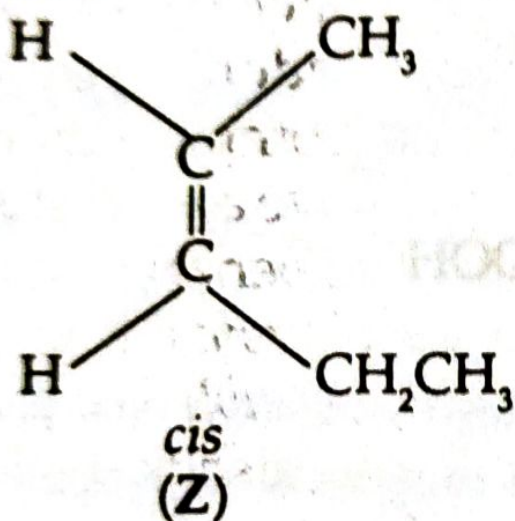
6. (i) 2-Butene



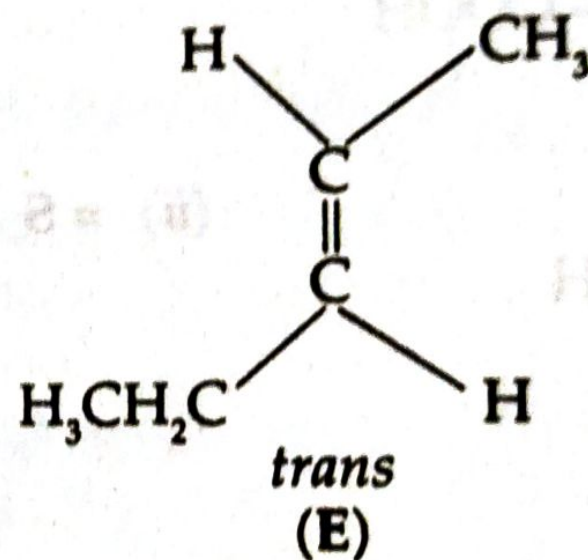
(ii)



(iii) 2-Pentene



(iv)



(ii) and (iv) do not show geometrical isomerism.