1. At higher grade level we thought that there were three unsaturated isomers with the formula C_4H_8 , namely but-1-ene, but-2-ene, and 2 methyl propene. This though ignores the possibility of geometric isomers.

(a) Draw the structural formulae of the three isomers named above.
(b) For each of the isomers draw and name any geometric isomers which exist.

2. The boiling point of cis-dichloroethene is 333K whilst that of trans-dichloroethene is 321K.

(a) Draw the structure of the molecules of each geometric isomer.
(b) Explain the difference in boiling point in terms of the polarity of each molecule.
(c) Explain why cis and trans isomers of 1,2 dichlorethane do not exist.

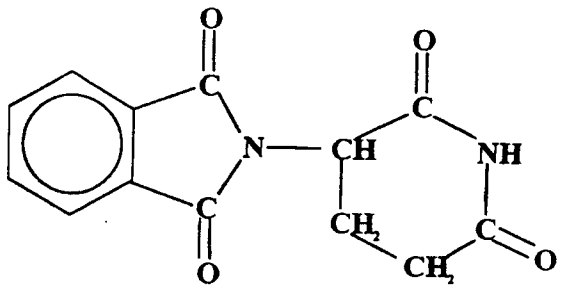
3. The simple amino acid, alanine, has the systematic name 2 aminopropanoic acid.
It exists naturally as the d isomer only.

(a) Draw the structural formula of alanine. Label the chiral carbon atom.
(b) Explain what is meant by the d isomer.
(c) How would you showthat a sample was the d and not the l isomer.

4. 2 hydroxypropanoic acid (lactic acid) exists as optical isomers due to the presence of a chiral carbon atom. A commercial sample of citric acid will contain equal amounts of the d and l isomers.

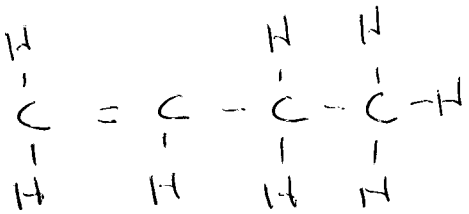
(a) Draw the structural formula of 2 hydroxypropanoic acid.
(b) Explain what a chiral carbon atom is.
(c) Identify the chiral carbon atom in 2 hydroxy propanoic acid.
(d) Draw 3d structures to represent the 3 stereoisomers of lactic acid.
(e) How would you show that a sample of lactic caid contained equal amounts of the d and l isomers.

6. Thalidomide is a drug which can exist in both L and D forms. One form is beneficial for morning sickness during pregnancy whilst the other produces abnormalities in the developing foetus.
Using the molecular structure on the right explain why thalidomide can exist in both L and D forms.

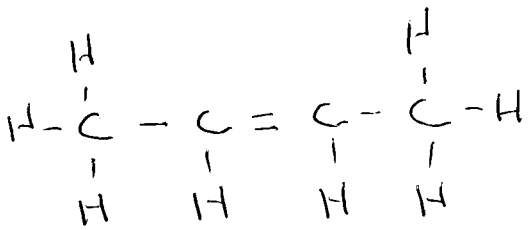


ANSWERS 3.14

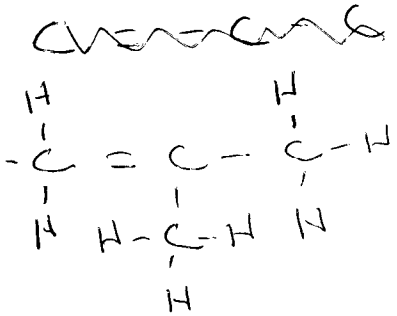
1. (a)



but-1-ene



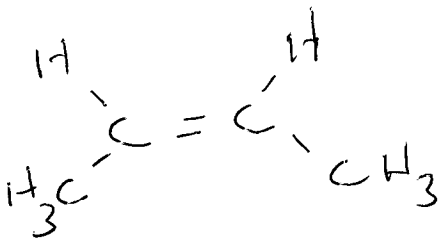
but-2-ene



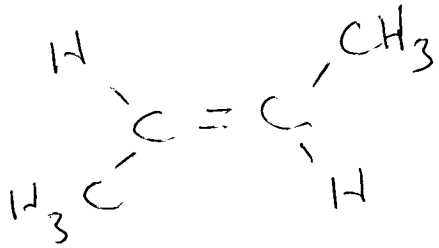
2 methyl propene

(b)

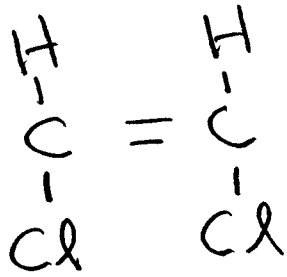
cis-but-2-ene



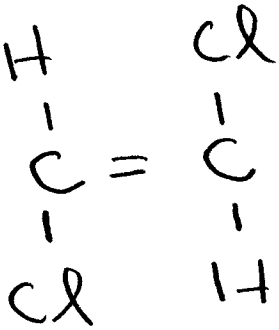
trans-but-2-ene



2. (a)



cis-dichloroethene

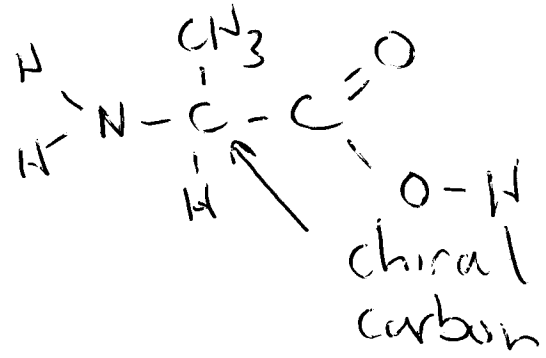


trans-dichloroethene

(b) trans-dichloroethene has little overall polarity as the two polar C-Cl bonds point in opposite directions, therefore polarity cancels. cis-dichloroethene does have overall polarity as C-Cl bonds are on the same side of C=C bond therefore they point approximately in the same direction. Since cis-dichloroethene molecules have a permanent dipole attractive forces between the molecules will be greater thus producing a higher boiling point.

(c) carbon to carbon single bond can easily rotate

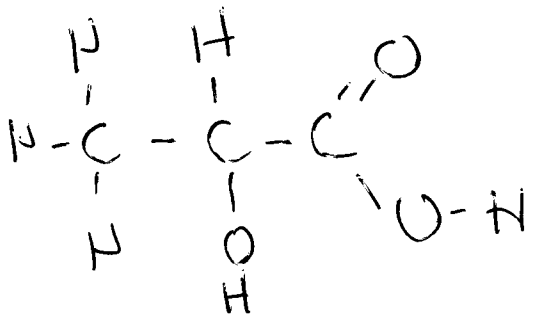
3 (a)



(b) it is one of the two possible optical (stereo) isomers that can exist for this molecules

(c) Pass plane polarised light through a solution of each isomer. one isomer would rotate the plane of the polarised light clockwise, the other isomer would rotate it anticlockwise

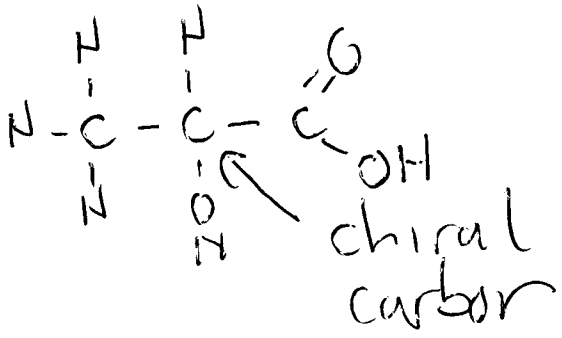
4. (a)



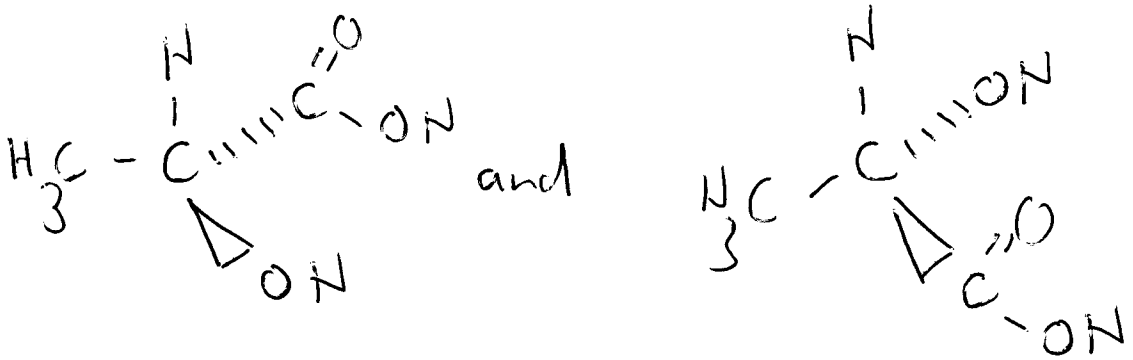
(b)

a chiral carbon is a tetrahedral carbon that has 4 different groups attached to it.

(c)



(d)



(e)

Pass plane polarised light through a solution of the isomers. If both isomers are present in equal ~~am~~concentration plane of polarised light should not rotate