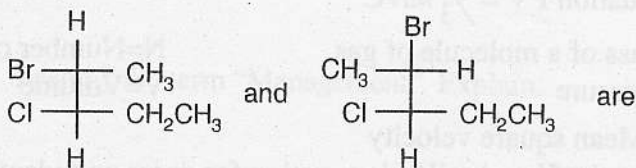1. (i) Draw the structure of the following molecules
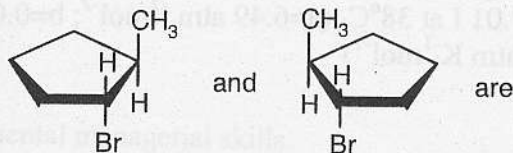   a. (2S, 3R)- 2-bromo-3-chloropentane
   b. (S)- 2-chlorohexane

(ii) Label each pair of structures as one of the following: constitutional isomers, enantiomers, diastereomers, or identical (includes conformers). Justify your answer.
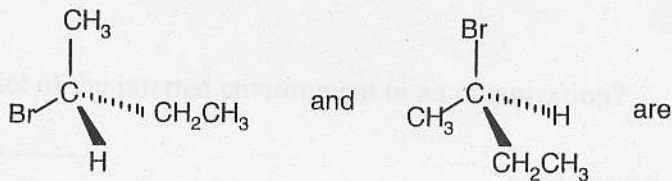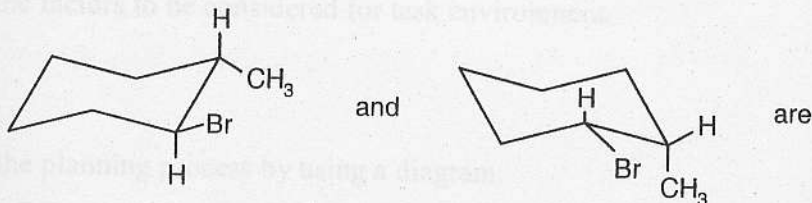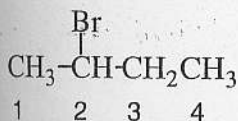
a.

and

are

b.

and

are

c.

and

are

d.

and

are

(iii) a. Draw a Newman projection about the C2–C3 bond which shows the largest groups *anti* to each other.

$$CH_3-CH-CH_2CH_3$$
1   2   3   4

b. Draw a Newman projection about the C2-C3 bond for a staggered conformer that is higher in energy than the conformer you drew in part a.

2. (i) a. Draw the lower energy conformer of the *cis* geometric isomer of this compound. F the purposes of this problem, assume that F has a smaller size than CH_2CH_3.
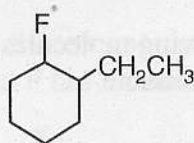
b. Draw the lower energy conformer of the *trans* geometric isomer in part a.

(ii) a. Write down the assumptions made in deriving the kinetic molecular theory of gas.

b. Derive the equation $PV = \frac{1}{3} mN\overline{C^2}$

Where m=mass of a molecule of gas   N=Number of molecules of the gas

P=Pressure   V=Volume

$\overline{C^2}$ =Mean square velocity

c. (i) Write down the Van der Waals equation for gases and identify all the terms in it.

(ii) Calculate the pressure exerted by 3.55 moles of molecular chlorine confined in volume of 7.01 l at 38°C. (a=6.49 atm l^2mol^{-2}; b=0.0562 $lmol^{-1}$; R=0.0821 latm $K^{-1}mol^{-1}$)