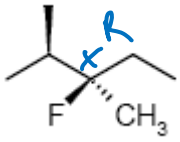
CHEM 2E03 Tutorial #5

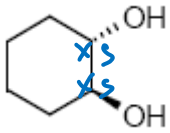
1. a) For each of the following molecules determine if the compound is chiral, achiral, or meso.
   b) Where appropriate, identify all chirality centres in the structure with an asterisk (*) and determine the configuration (*R* or *S*).
   c) Calculate the maximum number of stereoisomers the molecule can have.

a)



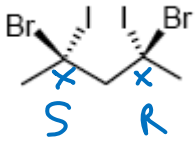
Chiral 2^1 Stereoisomers

b)



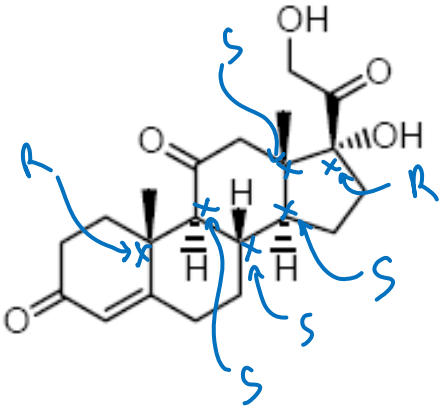
Chiral 2^2 Stereoisomers

c)



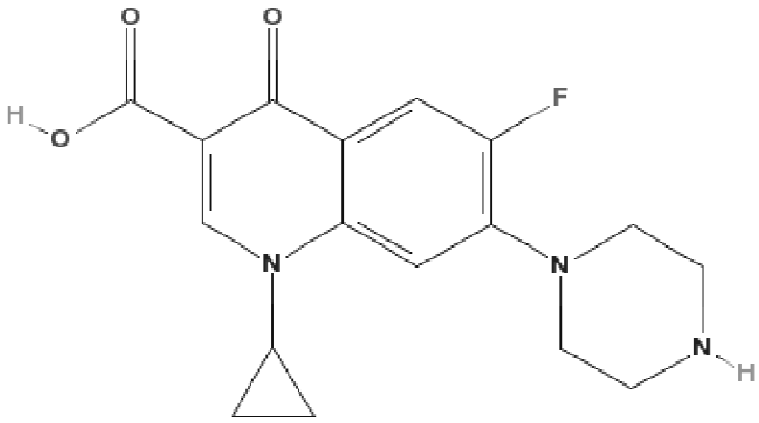
Meso (achiral)
2^2 Stereoisomers

d) Cortisone



Chiral 2^6 Stereoisomers

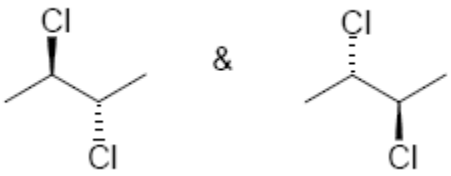
e) Ciprofloxacin (Anthrax treatment)



Achiral

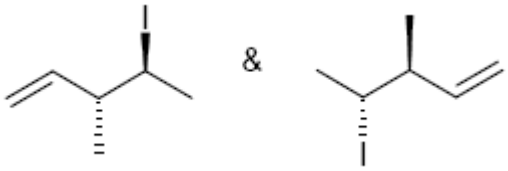
2. Identify the relationship between the following pairs of structures by describing them as constitutional isomers, enantiomers, diastereomers, meso compounds, or identical.

a)



Meso compounds

b)

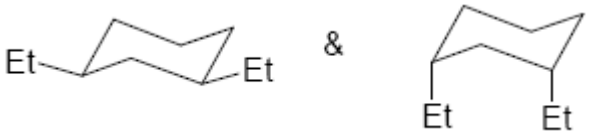


Enantiomers

c)

Identical

d)

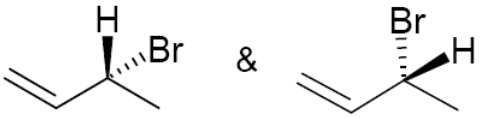


Meso compounds

e)

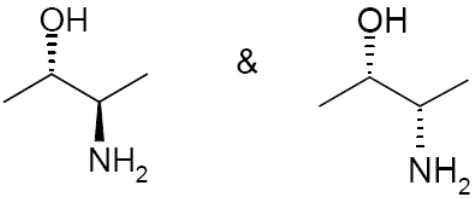
Identical

f)



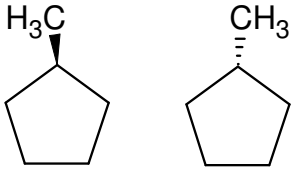
Identical

g)



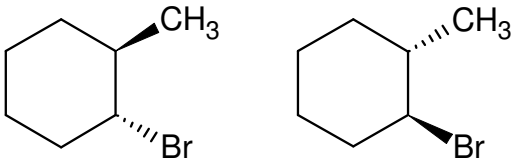
Diastereomers

h)



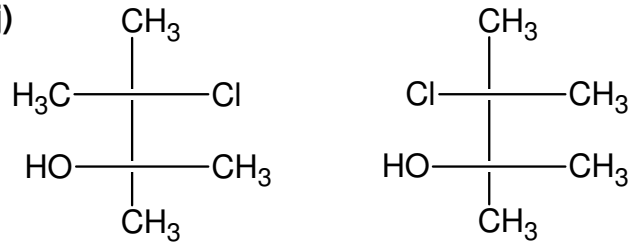
Identical

i)



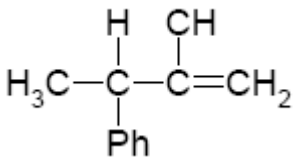
Enantiomers

j)



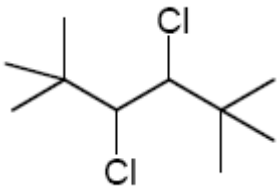
Identical - there is no chirality centre in this molecule

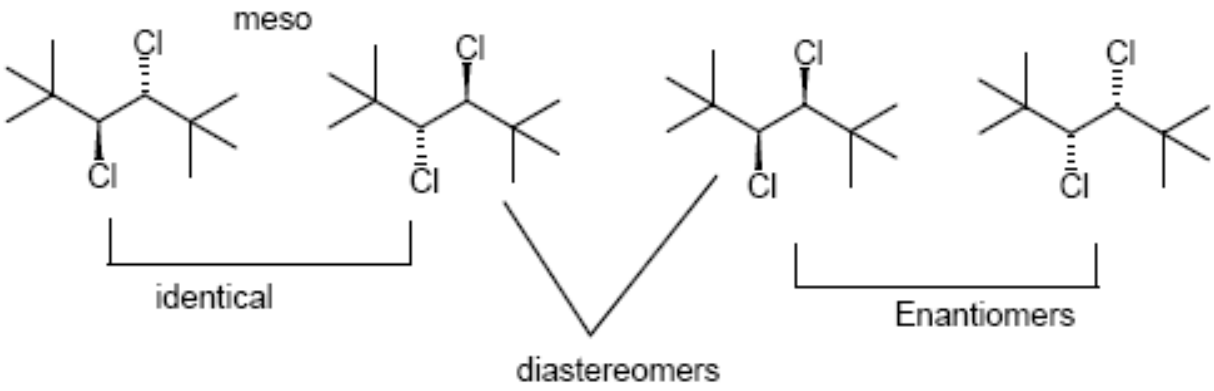
3. **The specific rotation of the R enantiomer of the following alkene is $[\alpha]_D^{20}$ = +76 degree·mL·g^{-1}·dm^{-1}, and its molecular mass is 146.2 g/mol. What is the observed rotation of a 0.5 M solution of this compound in a 5 cm sample path?**



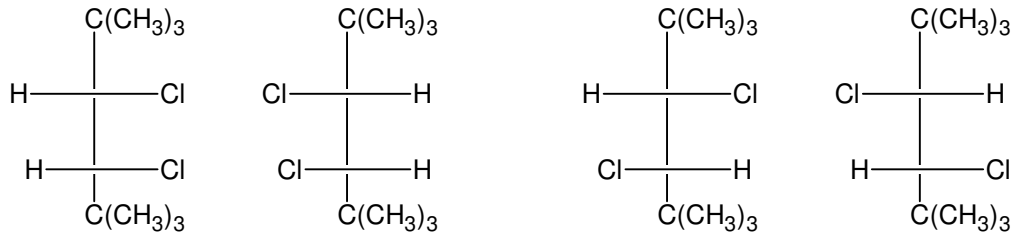
α = [α] c l
= (+76 degree·mL·g^{-1}·dm^{-1}) (0.5 mol/L x 1L/1000 ml x 146.2 g/mol) (0.5 dm)
= + 2.78°

4. **Draw all the stereoisomers of the following compound. Indicate the relationship between the molecules.**





Fisher projections make it easier to 'see' the relationships between these molecules



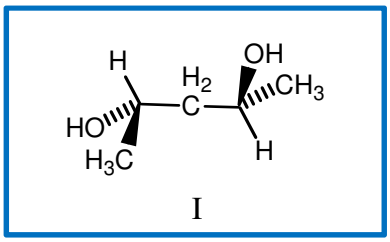
Meso –plane of symmetry
Rotating the 2nd molecule 180°
in the plane of the paper produces
the 1st molecule

Enantiomers: nonsuperposable mirror images

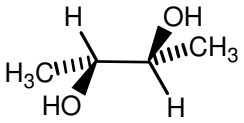
5. What is the molecular formula for the alkane of smallest molecular weight which possesses a chiral center?

C_7H_{16} is the smallest alkane that possesses a chiral centre.

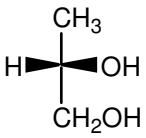
6. Which of the following is (are) a *meso* compounds?



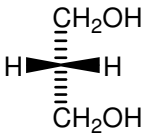
I



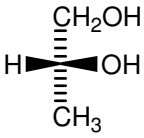
II



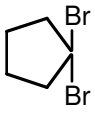
III



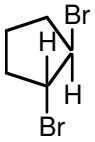
IV



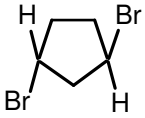
V



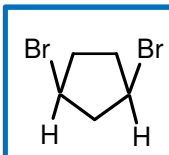
I



II



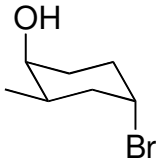
III



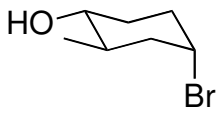
IV

7. What is the relationship between the following sets of compounds?

A) Diastereomers

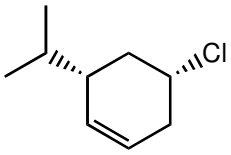


I

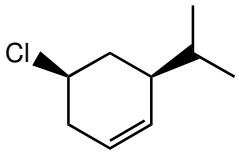


II

B) Identical

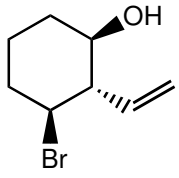


I

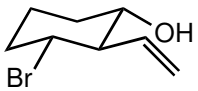


II

C) Enantiomers



I



II

D) Diastereomers