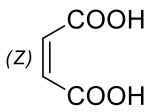
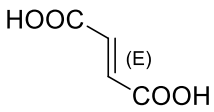
STEREOCHEMISTRY

1) What products are formed when

a) maleic acid



b) fumaric acid

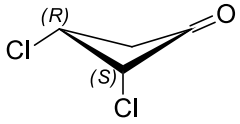


is treated with bromine in the cold and in the absence of light? Justify your answer from a consideration of the reaction mechanism.

2) Draw the products from the reaction of *trans*-2-bromo-4-chlorocyclobutanone with $LiAlH_4$ by attack from the *Re* and from the *Si* sides. Deduce the absolute configuration of the reaction products.

3) Draw the structural formulae of the products from the reaction of bicyclo[2.2.2]octene with
a) a peracid and
b) with potassium permanganate.
Show whether the products are chiral or achiral.

4) What is the product obtained from the reduction of (2*S*,3*R*)-2,3-dichlorocyclobutanone with $LiAlH_4$ by attack from the *Re* side?

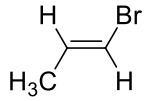


(2*S*,3*R*)-2,3-dichlorocyclobutanone

5) What products are obtained from the bromination of cinnamic acid [(*E*)-3-phenylpropenoic acid]? Draw the structural formulae of the products as Fischer projection formulae. What relationship do the products have to one another?

6) Are the two faces of the double bonds in the compounds represented by the following formulae homotopic, enantiotopic or diastereotopic? Give, where appropriate, a suitable descriptor for the face orientated towards you.

a)



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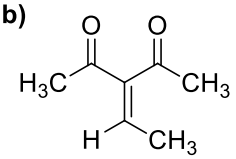
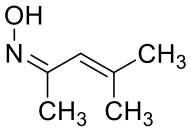
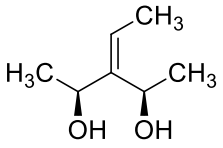


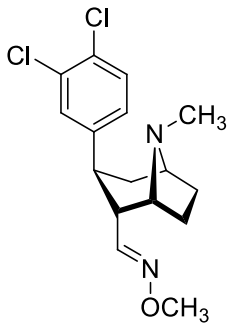
c)



d)



7) Assign suitable stereodescriptors to the dopamine reuptake inhibitor brasofensine.

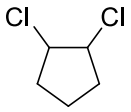


8) Draw the structural formulae of the products which are obtained when the bromonium ion obtained formed from
a) maleic acid and
b) fumaric acid,
and bromine is treated with methanolate. Use Fischer projection formulae to compare the structures of the products.

9) Draw the structural formula of the product obtained when (1*S*,2*R*)-1-bromo-2-fluoro-1,2-diphenylethane undergoes β-elimination of HBr. What product is obtained when the substrate is the *R,R* or the *S,S* isomer?

10) From the constitutional formulae given below, first of all draw formulae for all the possible configurational isomers and then deduce how many sets of chemically equivalent hydrogen atoms are present in the represented compounds.

a)



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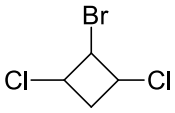

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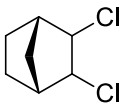
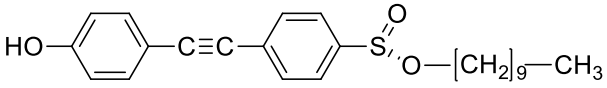
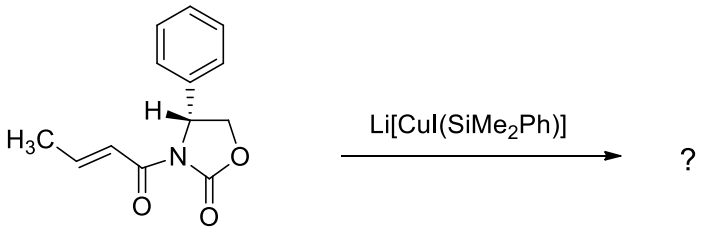


11) What is the configuration of the compound represented by the following formula?



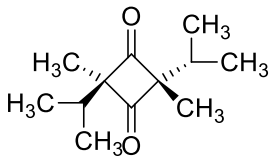
12) Which diastereomer of 1,3-dichlorocyclopentane has a ^{1}H NMR spectrum which contains four signals with relative intensities 1:1:1:1?

13)



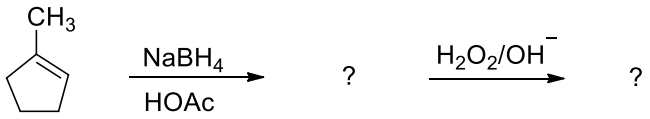
Determine the configuration of the products formed.

14) How many stereoisomers result from the non-selective reduction of the following substituted cyclobutanedione with $LiAlH_4$? What are the topicities of the hydrogen atoms at positions 1 and 3 in the reaction products?



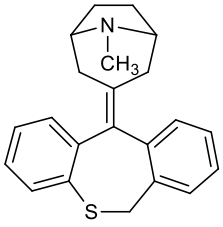
15) What compound would be expected as the major product from a Grignard reaction between (*S*)-2,3,3-trimethylbutanal and propylmagnesium bromide? (Hint: Use Cram's rule).

16)



Determine also the configuration of the intermediate product.

17) Is tropatepine, a drug used in the treatment of Parkinson's disease, chiral?



18) Devise a synthesis for the pure enantiomers of (*R*)- and (*S*)- methyloxirane.
(Hint: One route for the synthesis of both can begin with (*S*)-lactic acid ethyl ester).