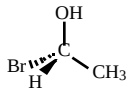
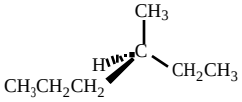
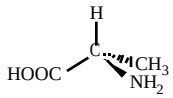
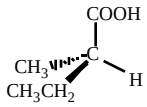
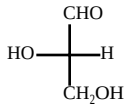
1. Which of the compounds below has an R configuration?

a) 

d) 

b) 

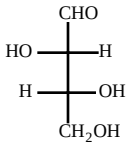
e) 

c) 

2. Which of the compounds below exists as only three stereoisomers?

a) 1,4-dibromobutane
b) 2,3-dibromobutane
c) 2,3-dibromopentane
d) 1,1-dibromocyclopentane
e) 1,4-dibromocyclohexane

3. The carbohydrate D-threose has the following Fischer projection:



Assign R or S configuration to the two chirality centers in D-threose.

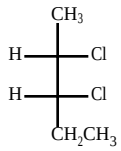
a) (2R, 3R)
b) (2R, 3S)
c) (2S, 3R)
d) (2S, 3S)

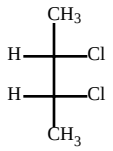
4. Which of the following compounds is/are chiral?

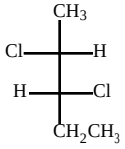
I. 1,1-dichloropentane
II. 1,2-dichloropentane
III. 3-chloropentane
IV. 2,3-dichloropentane

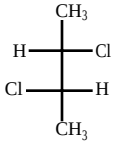
a) II
b) II and IV
c) IV
d) II, III and IV
e) I and III

5. Which of the following is a *meso* compound?

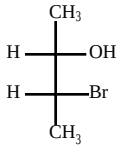
a) 

c) 

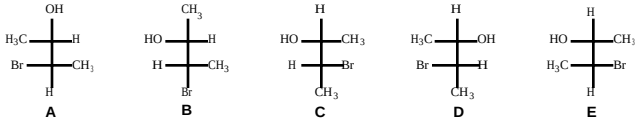
b) 

d) 

6. Consider the molecule below:



Which of the structures shown is a diastereomer of this molecule?



7. Which of the following statements about (R)-2-methyl-1-butanol can only be confirmed by performing an experiment?

a) It rotates plane-polarized light to the right (clockwise).
b) An equal mixture of it and its enantiomer is optically active.
c) (S)-2-methyl-1-butanol has the same boiling point.

8. Which statement or statements concerning (2R, 3S)-2,3-dichloropentane and (2R, 3R)-2,3-dichloropentane is/are <u>true</u>?

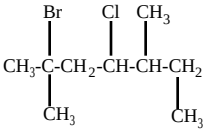
I. They have the same melting point.
II. They have the same density.
III. They have equal but opposite rotation of plane-polarized light.

a) None of these.
b) I
c) II
d) III
e) I, II, and III

9. Consider the reaction of *trans*-2-butene with Br_2 in CH_2Cl_2. Which statement concerning this reaction is correct?

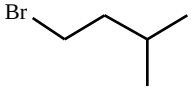
a) The product is optically active because it possesses two chirality centers.
b) The product is optically inactive because it is a racemic mixture of enantiomers.
c) The product is optically inactive because it is *meso.*
d) The product is optically inactive because it does not possess any chirality centers.
e) The product is optically inactive because it is a racemic mixture of diastereomers.

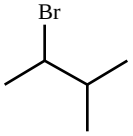
10. What is the correct IUPAC name for the following compound?

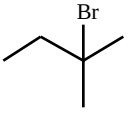


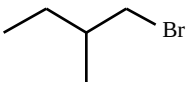
a) 2-bromo-4-chloro-2,5,6-trimethylhexane
b) 2-bromo-4-chloro-2,5-dimethylheptane
c) 6-bromo-4-chloro-3,6-dimethylheptane
d) 2-bromide-4-chloride-2,5,6-trimethylhexane
e) 2-bromine-4-chlorine-2,5,6-trimethylhexane

11. Which of the following is most likely to undergo nucleophilic substitution via an S_N2 pathway?

a) 

b) 

c) 

d) 

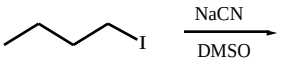
12. Which of the following correctly identifies the characteristics of an S_N2 reaction?

	Number of steps	stereochemistry
a)	1	racemization
b)	1	inversion
c)	1	retention
d)	2	racemization
e)	2	retention

13. Which of the substances below will react the fastest when treated with NaCN and DMSO?

a) CH_3–F
b) CH_3–Cl
c) CH_3–Br
d) CH_3–I
e) CH_3–OTos

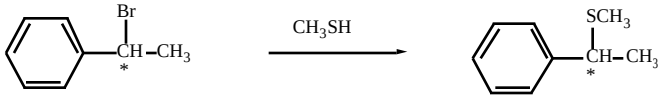
14. Consider the reaction of 1-iodobutane with the cyanide ion:



What would happen to the rate of the reaction if the concentration of <u>both</u> the cyanide ion and the 1-iodobutane are doubled?

a) no change
b) rate doubles
c) rate triples
d) rate quadruples
e) rate is halved

15. When (S)-1-bromo-1-phenylethane undergoes an S_N1 reaction with methanethiol (CH_3SH), the product is the compound shown.

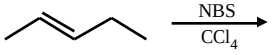


What is/are the configuration(s) of the product obtained from this reaction?

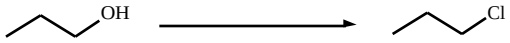
a) (S) only
b) (R) only
c) A mixture of (R) and (S), with slightly more (S) than (R).
d) A mixture of (R) and (S), with slightly more (R) than (S).

Reactions

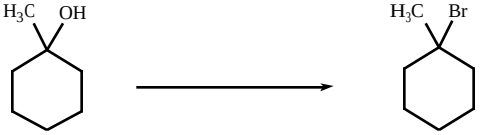
1. Draw all possible products for the following reaction.



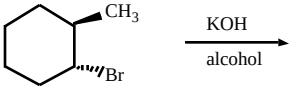
2. What reagents are required?

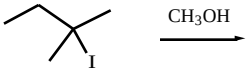


3. What reagents are required?



4. Draw the major product:

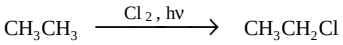


5. 

(give two products, major and minor)

Mechanisms

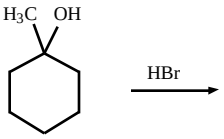
1. Write the complete mechanism for the monochlorination of ethane:



Include all steps, and provide the appropriate labels for the steps ("initiation", etc.).

2. Give the complete mechanism for the following reaction, using the curved arrow formalism.

3. Give the complete mechanism for the following reaction, using the curved arrow formalism.



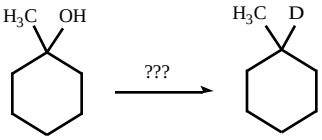
4. Give the complete mechanism for the following reaction, using the curved arrow formalism.

Synthesis. Show how the following syntheses could be performed. More than one step may be required. Show all reagents and all intermediate compounds in your synthetic scheme.

1. cyclopentene $\xrightarrow{???}$ methylcyclopentane

2. 1-bromobutane $\xrightarrow{???}$ octane

3. cyclohexanol $\xrightarrow{???}$ butylcyclohexane

4. 

Short Answer.

Compound **A**, C_6H_{12}, was found to be optically active. On catalytic reduction over a palladium catalyst, one equivalent of hydrogen was absorbed, yielding compound **B**, C_6H_{14}. When compound **A** was treated with $KMnO_4$ in an acidic solution, CO_2 bubbled out and compound **C** was formed. Compound **C** has the formula $C_5H_{10}O_2$, and it is an optically active carboxylic acid. Draw the structures of compounds **A**, **B**, and **C**.