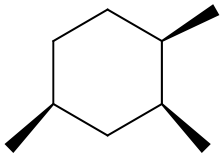
Organic 211 Test # 3 November 7, 2013

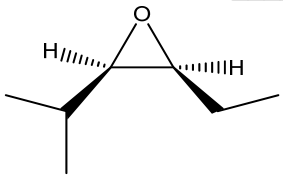
Name:_____

Directions: Work every problem. NO CALCULATORS ALLOWED.

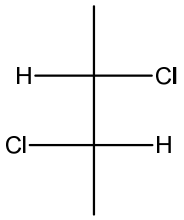
1) Compare the names to the structures. If the structure has a name that matches, write its letter in the blank. If the name for the structure is not here, write NH. This could be very tricky. (2 pts. each)



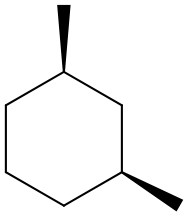
_____ A = (S,E)-pent-3-en-2-ol



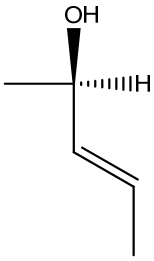
_____ B = Meso-1R,3R-1,3-dimethylcyclohexane



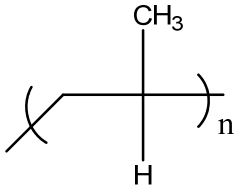
_____ C = Polypropylene



_____ D = (1R, 2S, 4S)-1,2,4-trimethylcyclohexane



_____ E = (2S,3S)-2,3-dichlorobutane



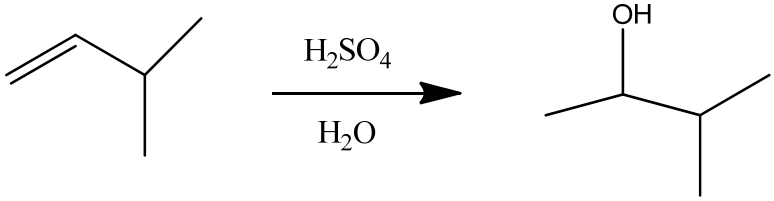
_____ F = (3R, 4R)-3,4-epoxy-2-methylhexane

2) Peroxides influence whether HBr adds in a Markovnikov fashion or anti-Markovnikov fashion to alkenes. Explain this fact. (3 pts.)

3) Write equations describing the preparation of three isomeric alcohols of molecular formula $C_5H_{12}O$ from alkenes. (3 pts.)

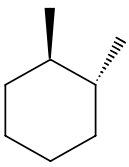
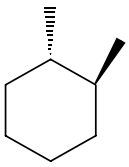
4) Give a brief contrast between an SN_1 reaction and an SN_2 reaction explaining how the two mechanisms differ. (3 pts.)

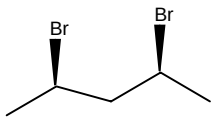
5) On the basis of the mechanism of acid-catalyzed hydration, can you suggest why the reaction below would probably not be a good method for the synthesis of 3-methy-2-butanol? (3 pts.)

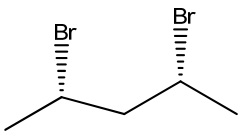


Problems: Work the following problems.

6) Identify how the following pairs of molecules are related. (same/meso, same/not meso, constitutional isomers, enantiomers, diasteromers, no relation) (2 pts. each)

a)  vs  _____

b) 

vs 

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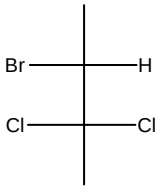
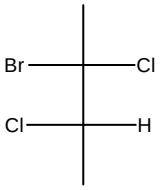
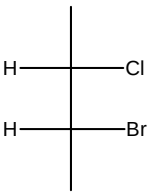
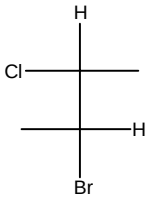
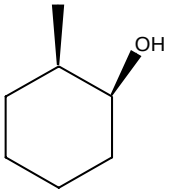
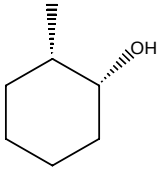
c) 

vs 

d) 

vs 

e) 

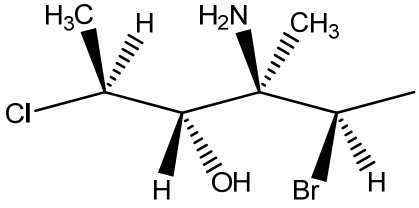
vs 

7) R-2,2-dimethylcyclohexan-1-ol has a specific rotation of +80^{o}. You have an observed rotation of -60^{o} for your mixture of the R and S enantiomers. (3 pts. each)

a) What is the percent enantiomeric excess? Show your work.

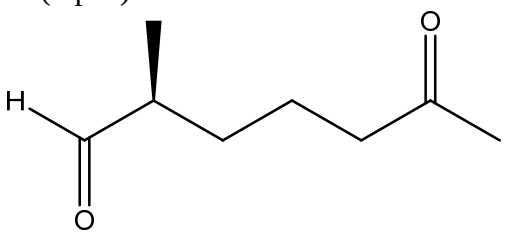
b) How much of each enantiomer is present?

8) Convert the following molecule to a Fisher projection. (5 pts.)



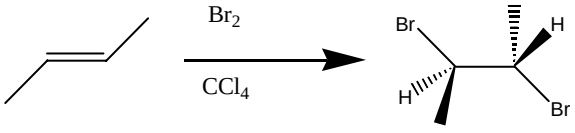
9) Molecule A contains two stereocenters, and has ONLY three stereoisomers.. Draw the three stereoisomers in a Fisher projection. Assign R and S to the stereocenters. (4 pts.)

10) Compound B has the molecular formula C_8H_{14} and is chiral. Treatment of compound B with ozone and Zn gives compound C shown below. Reaction of compound B with hydrogen and platinum gives Compound D (C_8H_{16}) that is meso. Draw compounds B and D. (4 pts.)

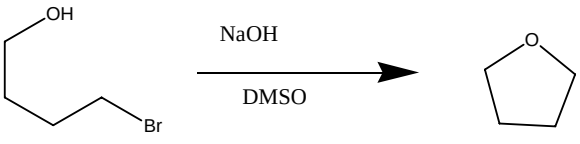


Compound C

Mechanisms: Work the following mechanisms.

11) 

(5 pts.)

12) 

(5 pts.)

13) Give the mechanistic symbols (SN_1, SN_2, E_1, E_2) that are most consistent with each of the following statements. (2 pts. each)

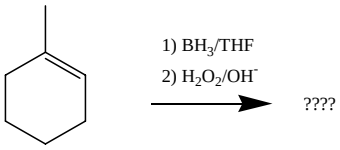
a) Unhindered primary halides react with sodium ethoxide in ethanol mainly by this mechanism. _____

b) These reaction mechanisms involve carbocation intermediates. _____

c) Alkyl iodides react faster than alkyl bromides in reactions that proceed by these mechanisms. _____

Reactions: Give the missing reactant, reagent, or product for the following reactions. Indicate stereochemistry if important. If enantiomers are formed, you may draw one product and write +E. Or if diasteromers are formed, you may draw one and write +D. Indicate if no reaction is possible. If an SN_1/E_1 reaction, do not draw the E_1 product. (2 pts. each)

14) a)



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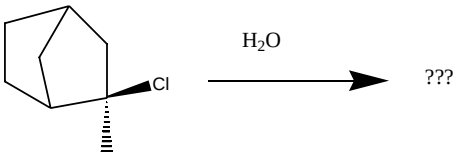

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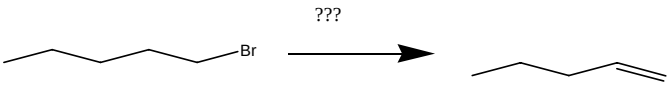

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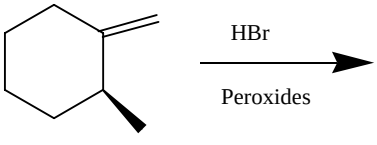

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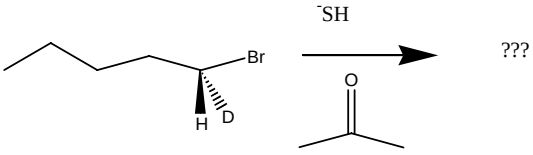

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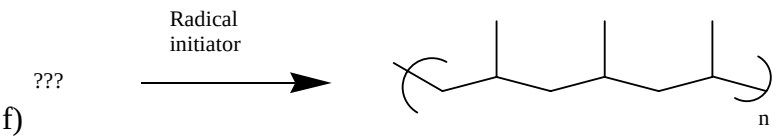

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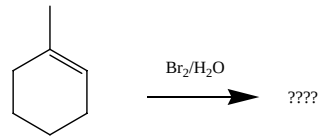
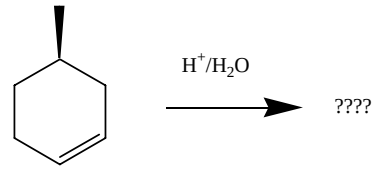
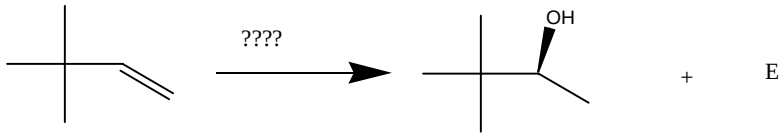


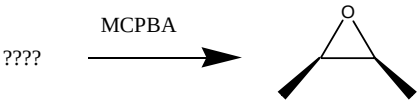
h)



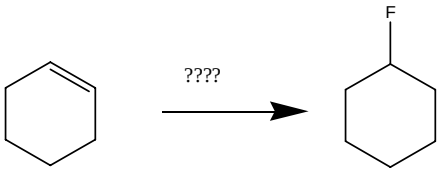
i)



j)



15) Synthesis (4 pts.)



16) Free question: Give something that you studied that wasn't asked on this test. (4 pts.)

Substitution/Elimination Determination Table

Reference: Dr. Mark Arant (University of Arkansas – Fort Smith) uses a table very similar to this one for determining whether a reaction goes SN_2, E_2 or SN_1/E_1.

pKa of conjugate acid of nucleophile	**Primary Halides**	**Secondary Halides**	**Tertiary Halides**
<10	SN_2	SN_2 – polar aprotic solvent SN_1/E_1 – polar protic solvent	SN_1/E_1
10-25	SN_2	E_2	E_2
>25	E_2	E_2	E_2

How to read the chart: 1) Determine whether the carbon that has the leaving group is primary, secondary, or tertiary. 2) Next, draw the conjugate acid of the nucleophile and determine its pKa.

Exceptions: a) This table determines the reaction most likely to take place. SN_1 and SN_2 are limiting reactions with most reactions taking place by a combination of mechanisms instead of by just one mechanism. b) If the base is bulky like tert-butoxide, elimination will dominate via E_2 even though the pKa of tert-butyl alcohol is less than 25. c) If the primary carbocation is stabilized (i.e. allyl or benzyl) the SN_1 reaction may dominate.