

Name: _____

Directions: The test is worth 106 points but scored out of 100.

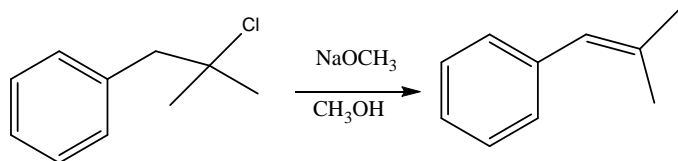
1) You have available 2,2-dimethylcyclopentanol (A) and 2-bromo-1,1-dimethylcyclopentane (B) and wish to prepare 3,3-dimethylcyclopentene. Which would you choose as the more suitable reactant, A or B, and with what would you treat it? (4 pts.)

2) Draw the two stereoisomeric alkenes that are formed in the catalytic hydrogenation of (E)-3-methylhex-2-ene. (4 pts.)

3) Draw all of the alkenes with the molecular formula C_7H_{14} that contains a tetrasubstituted double bond. Give the IUPAC name for two of your drawings. (4 pts.)

4) Why does the carbocation intermediate in the hydrolysis of 2-bromo-3-methylbutane rearrange by way of a hydride shift rather than a methyl shift? Show this rearrangement. (4 pts.)

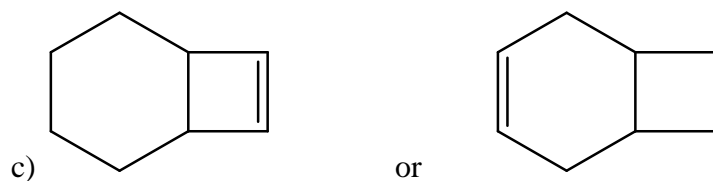
5) The reaction below can proceed through both E_1 and E_2 mechanisms. If the rate constants are the same, which reaction is faster? Explain your answer. (4 pts.)



6) Circle the more stable alkene in each of the following pairs. Explain your reasoning. (3 pts. each)

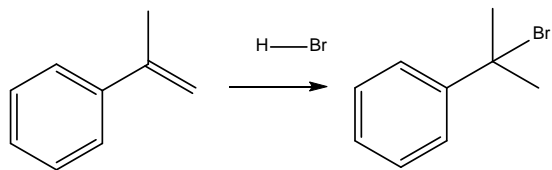
a) 1-methylcyclohexene or 3-methylcyclohexene

b) Isopropenylcyclopentane or allylcyclopentane

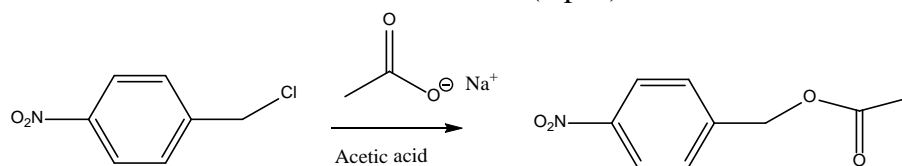


7) Sketch the potential energy diagram for the reaction of 1-heptanol with hydrogen bromide. Sketch the intermediates AND transition states. (5 pts.)

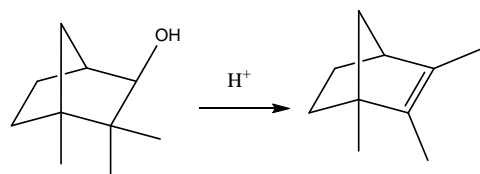
8) Show electron movement with arrows for the following reaction. (5 pts.)



9) Explain why the reaction below can go by TWO different mechanisms for the following reaction. Name the mechanisms as well. (5 pts.)

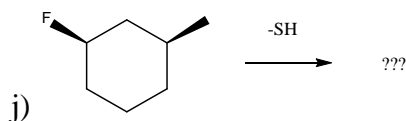
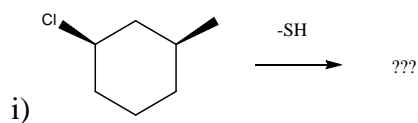
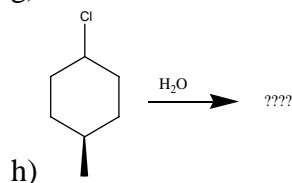
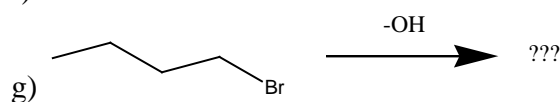
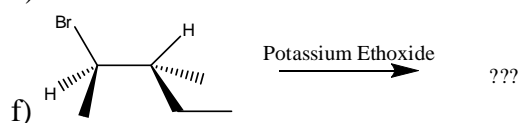
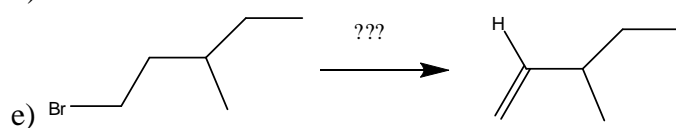
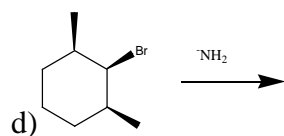
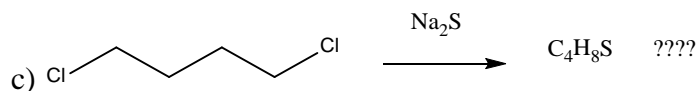
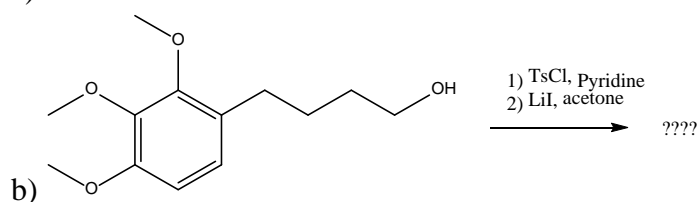
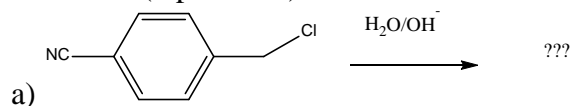


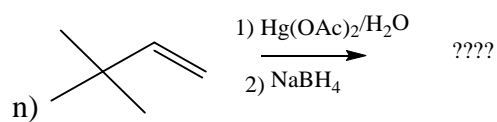
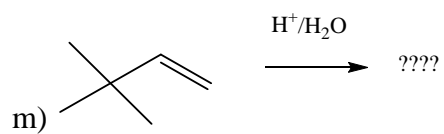
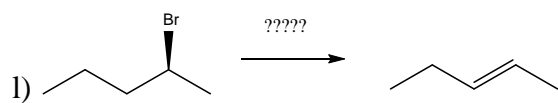
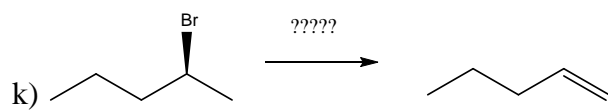
10) Show electron movement with arrows in the mechanism for this reaction. (6 pts.)



11) A study of the hydrolysis behavior of chlorofluorocarbons carried out by the EPA found that 1,2-dichloro-1,1,2-trifluoroethane underwent dehydrohalogenation on treatment with aqueous sodium hydroxide. a) Draw the product. b) Show electron movement with arrows in the mechanism for this reaction. (3 pts. each)

12) Reactions: Give the missing reactant, reagent, or product for the following reactions. Indicate if no reaction is possible. Show stereochemistry if important. For SN1/E1 reactions, it is not required to draw the E1 products. If the reaction forms enantiomers, you may draw one enantiomer and write +E. If the reaction forms diastereomers, you may draw one diastereomer and write +D. (3 pts. each)





13) Outline a synthesis of 2-butanol from 1-butanol using any necessary. (4 pts.)

14) Free Question: Give me something you studied that was not asked on this test. (4 pts.)

Substitution/Elimination Determination Table

Reference: Dr. Mark Arant (Northeast Oklahoma University) 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.