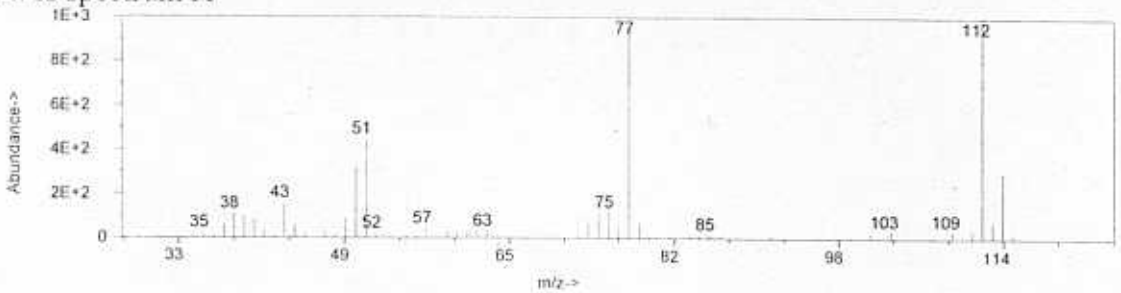
Exam 4 Chem 230 Fall '08

Your name KEY
Student ID#

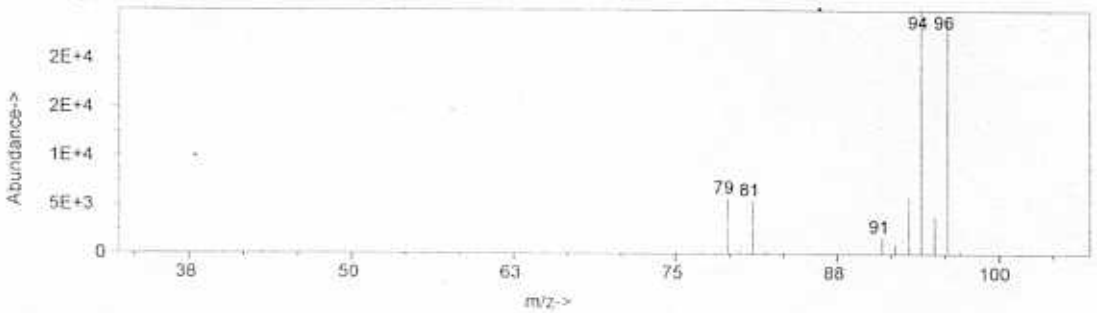
1. Consider the four spectra below.. You can assume that the heaviest m/z values correspond to M^+. Indicate with check marks which statements are TRUE: (10 pts)

	A	B	C	D
The compound contains bromine atom		✓		
The spectrum suggests the presence of a phenyl group	✓			
The spectrum suggests the presence of a chlorine atom	✓			
The spectrum suggests the presence of a benzyl group				
The spectrum suggests the presence of a long chain hydrocarbon			✓	
The spectrum suggests the presence of an odd number of nitrogen atoms				✓

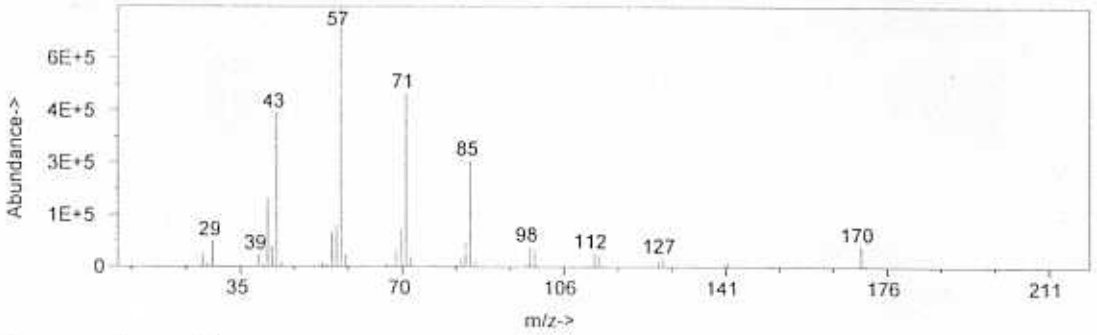
Mass spectrum A



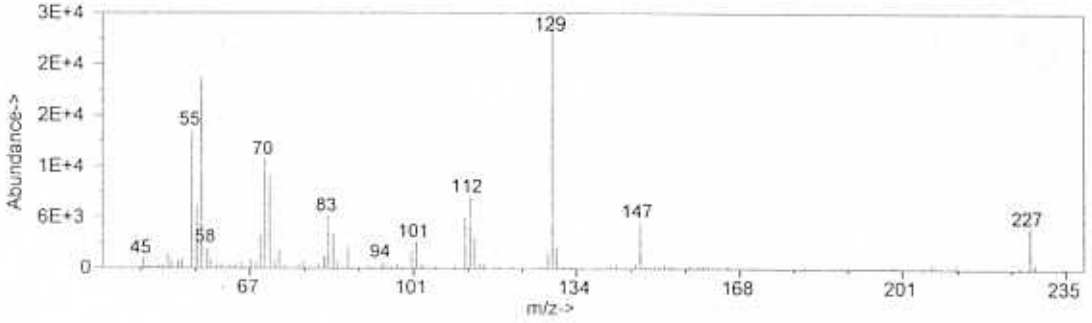
Mass spectrum B



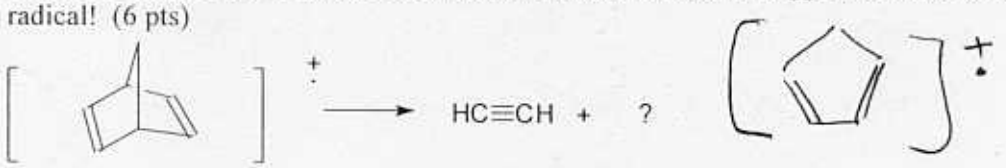
Mass spectrum C



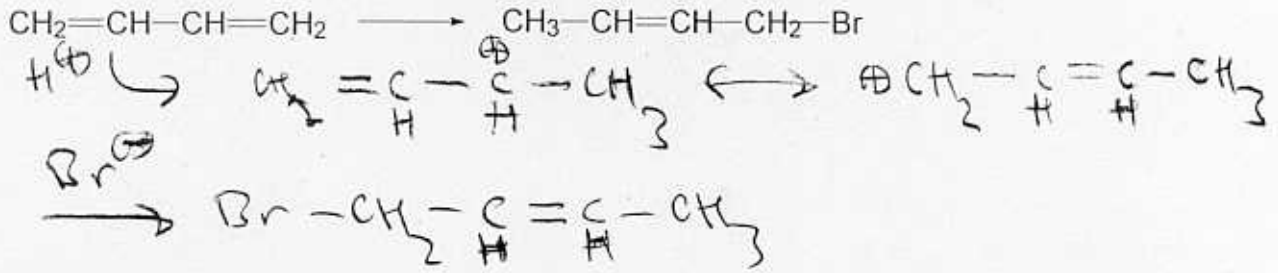
Mass spectrum D



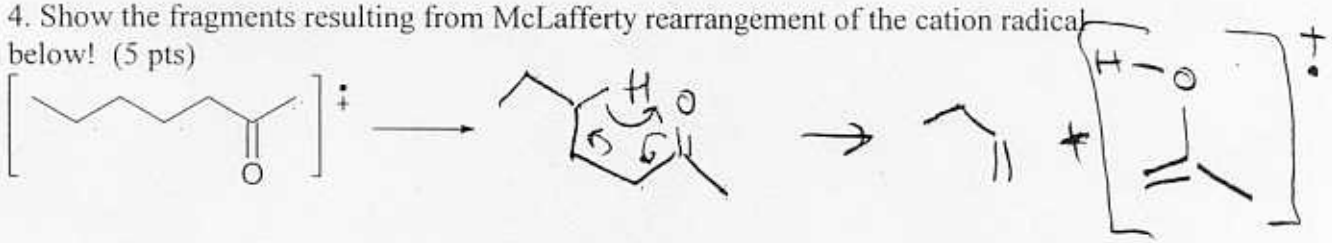
2. In the mass spectrometer, norbornadiene undergoes a reverse Diels-Alder reaction and fragments into acetylene and a cation radical, as shown below. Suggest a structure for the cation radical! (6 pts)



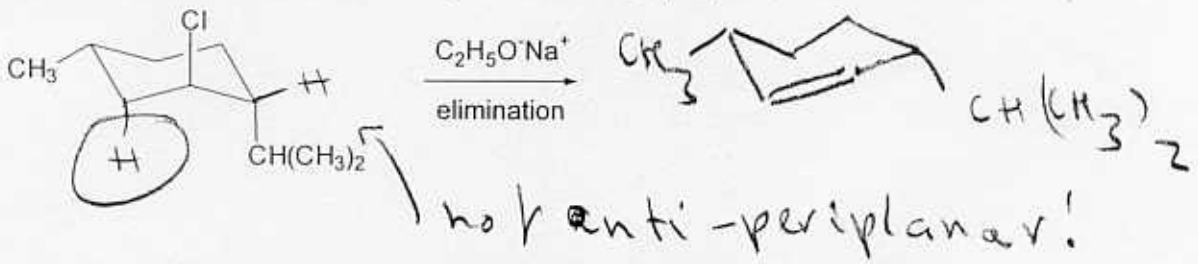
3. The addition of HBr to 1,3-butadiene generates significant quantities of 1-bromo-2-butene, as shown below. Show a detailed mechanism accounting for this observation! (6 pts)



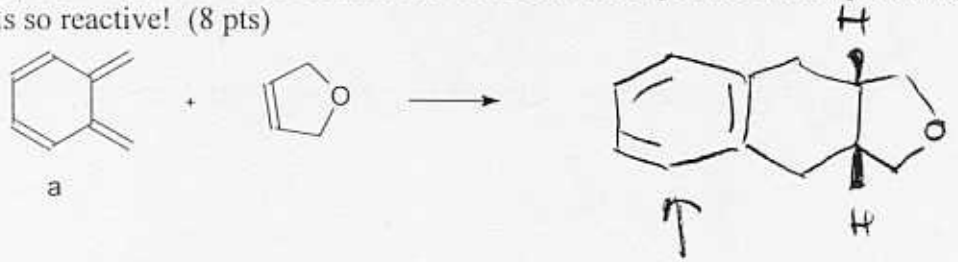
4. Show the fragments resulting from McLafferty rearrangement of the cation radical below! (5 pts)



5. Show a structural formula for the elimination product you expect to form in the reaction below! This follows an E_2 mechanism. (5 pts)

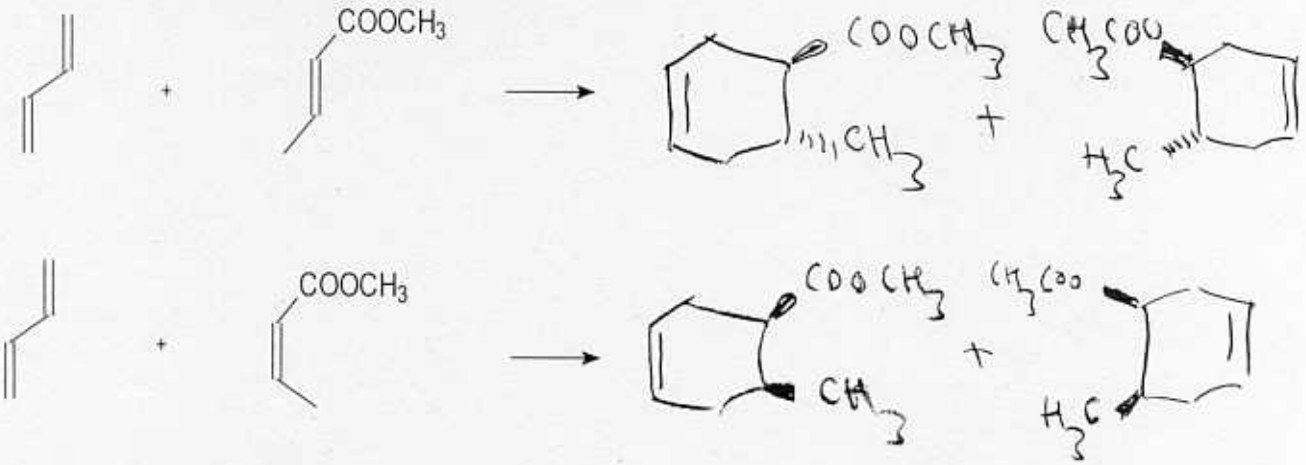


6. Compound *a* below is very reactive towards dienophiles. Complete the reaction below by showing a structural formula for the Diels-Alder product and explain why compound *a* is so reactive! (8 pts)

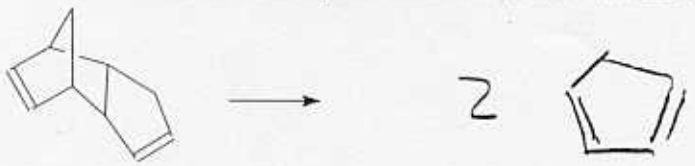


aromatic!

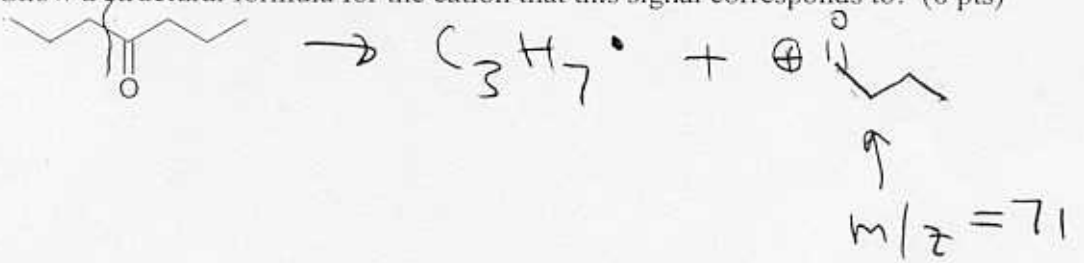
7. 1,3-Butadiene reacts with both (E)- and (Z)-methyl-2-butenoate. All corresponding Diels-Alder products are stereoisomers, in total of 4 compounds are obtained. Show all products incl. their correct stereochemistry! (10 pts)



8. The compound shown below undergoes reverse Diels-Alder addition upon heating. Show the diene and dienophile that are formed as this happens! (8 pts)

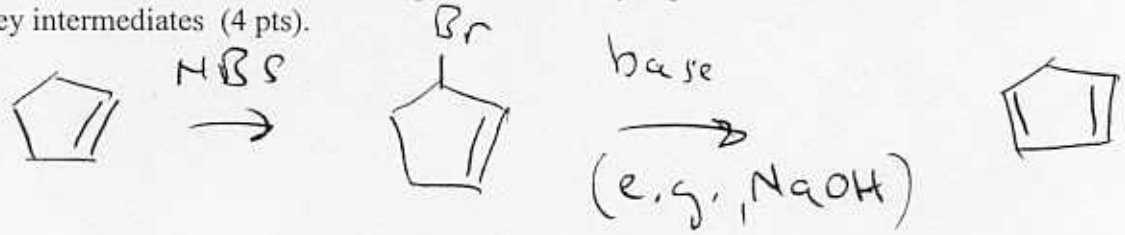


9. Mass spectra of 4-heptanone (shown below) display a prominent peak of m/z = 71. Show a structural formula for the cation that this signal corresponds to! (6 pts)

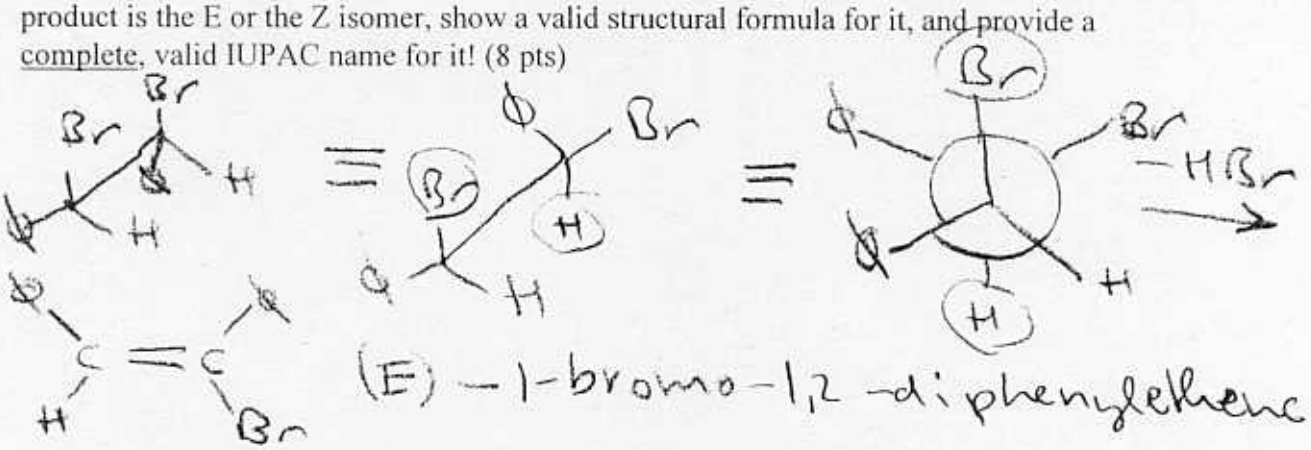


10. Propose a suitable diene and a dienophile to prepare the compound below! (4 pts)

11. Outline a method to convert cyclopentene to 1,3-cyclopentadiene! Show conditions and key intermediates (4 pts).



12. *meso*-1,2-Dibromo-1,2-diphenylethane under goes and E_2 elimination with loss of HBr when treated with a base, to generate the corresponding alkene. Decide whether the product is the E or the Z isomer, show a valid structural formula for it, and provide a complete, valid IUPAC name for it! (8 pts)

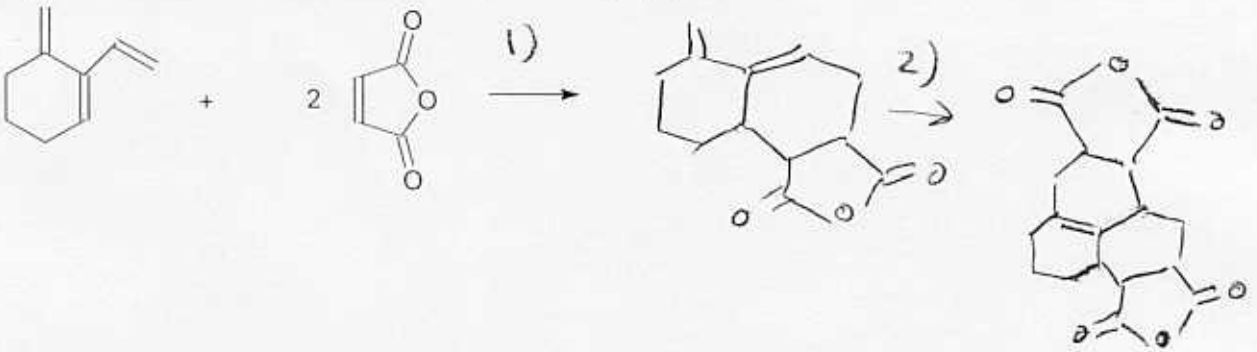


(E) – 1-bromo-1,2-diphenylethene

13. All attempts to eliminate HBr from the compound below and generate the corresponding alkene have failed. How can you rationalize this? Hint - the answer may be obvious to you if you draw a structural formula for the expected alkene. (3 pts).

double bond to bridgehead not possible

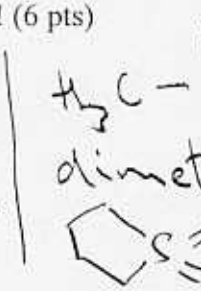
14. The triene shown below reacts with two moles of maleic anhydride to yield $C_{17}H_{16}O_6$ as product. Predict a structure for this product! (6 pts)



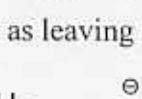
15. Provide formulas and names of a) two polar, protic solvents, b) two polar, aprotic solvents, c) two non-polar solvents! (6 pts)

H_2O water

CH_3OH methanol



dimethylsulfoxide



sulfolane

benzene

cyclohexane

16. Circle all species that commonly act as leaving groups! (5 pts)

$Br^{\ominus}$ $F^{\ominus}$ $^{\ominus}CH_3$ $^{\ominus}OH$ H_2O