

Cover Sheet! EXAM4-A

CHEM230-001 FALL 2003

PRINT your name legibly on the line below.

Name: _____

Student ID No: _____

First: You are allowed to have a writing utensil, a calculator and molecular model set at your seat. Please put away all other materials.

Second: Place your student identification on your desk. A proctor will come around to check everyone's ID. **Is your name and number on your test?**

Third: There is work space in the last two pages of the exam. Quickly read through the entire exam. Your goal, as always, is to score as many points as possible. Do not waste time on problems that you can't do if there are easy questions to do first.

Fourth: It is critically important that your answers be written in a clear, unambiguous manner. Answers in which your intentions are unclear will not receive credit. SHOW YOUR WORK!

Fifth: READ THE INSTRUCTIONS FOR EACH PROBLEM. answer each question

Problem Number	Points	My Performance
1	10	_____
2	10	_____
3	10	_____
4	10	_____
5	10	_____
6	10	_____
7	10	_____
8	10	_____
9	10	_____
10	10	_____
11	10	_____
12	10	_____
13	20	_____
14	10	_____
15	10	_____
16	15	_____
17	10	_____
18	10	_____
19	5	_____
Total	200	_____

Cumulative Part (100 pts)

1. (10 pts) Draw a line structure diagram for acetate: CH_3CO_2^- . Your structure must include all lone pairs and formal charges. C and H atoms may be shown either implicitly or explicitly for full credit.

Answer for 1:

2. (10 pts) Draw the structure of (Z)-1-chloro-2-pentene.

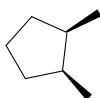
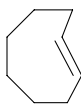
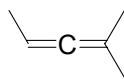
Answer for 2:

3. (10 pts) Draw the best structure of the E2 product of (1R, 2S)-1-bromo-2-methylcyclohexane and tBuOK.

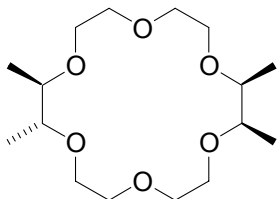
4. (10 pts) Circle the chiral molecules; draw an X over the achiral molecules.

Answer for 3:

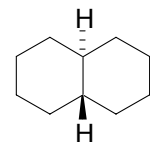
structures for 4.

*trans*-1,2-dimethylcyclopentane*trans*-cyclooctene

2,3-pentadiene

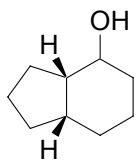


2,3,11,12-tetramethyl-18-crown-6

*trans*-decalin

5. (10 pts) How many possible stereoisomers (enantiomers + diastereomers) does 4-methyl-3,5-heptanediol have? _____

How many possible stereoisomers (enantiomers + diastereomers) does 2-methyl-3,4-pentanediol have? _____



6. (10 pts) Upon treatment with H_3O^+ the bicyclic carbon framework at left rearranges to make a bicyclic alcohol. **Please draw the structure.**



7. (10 pts) Draw the high-energy conformation of this molecule.

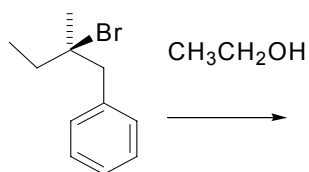
Answer for 7:

Answer for 6:

8. (10 pts)

Draw the $\text{S}_{\text{N}}1$ products of this optically pure starting material.

problem 8



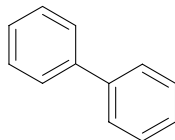
9. (10 pts) Draw a Newman projection of the most stable conformation of (S)-2-chlorobutane. Put the carbon attached to the chlorine in front and sight down the bond between C2 and C3. Hint: the lowest energy conformation of 1-chloro-1-methylcyclohexane puts Cl in an axial position.

Answer for 9:

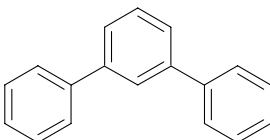
10. (10 pts) How many ^{13}C signals are there in the following molecules?



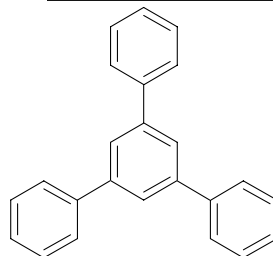
2 pts. ____



2 pts. ____

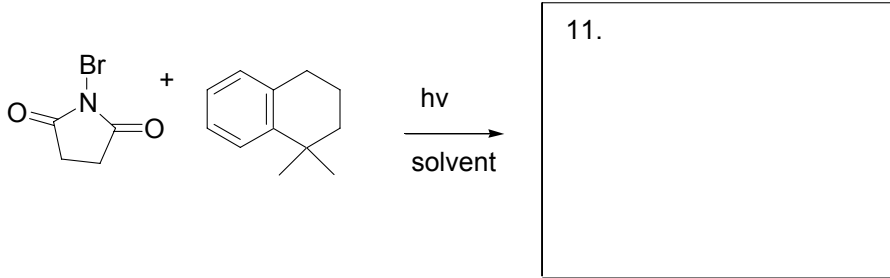


3 pts. ____

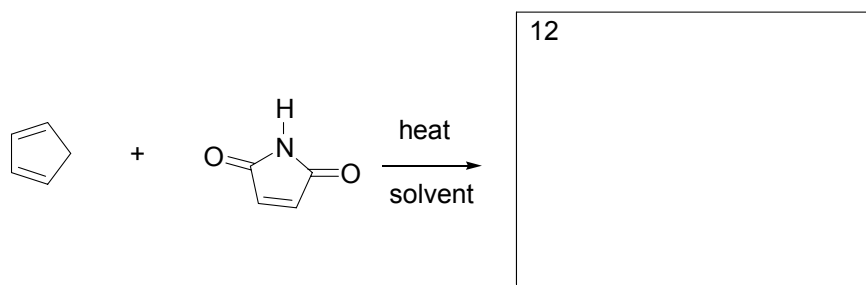


3 pts. ____

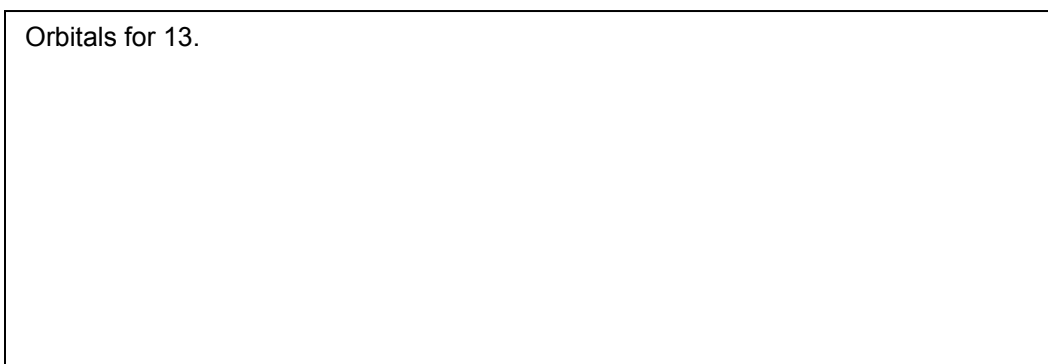
11. (10 pts) Predict the product.



12. (10 pts) Predict the Diels-Alder product. Stereochemistry is very important!



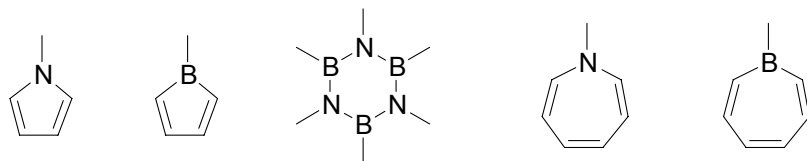
13. (9 pts) Draw **three** lowest-energy molecular orbitals of **cyclopentadienyl anion**. Label these X1-X3 with one being the lowest-energy orbital. Hint, two of them have the same energy, in lecture we counted bonding, antibonding and non-bonding components in molecular orbitals. You may look at the pi-system from above and draw the atomic p orbitals as circles.



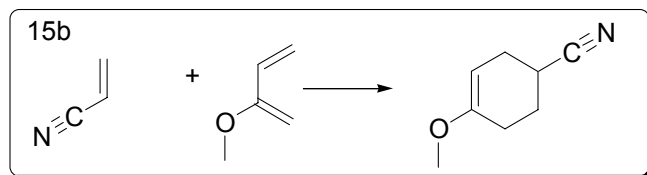
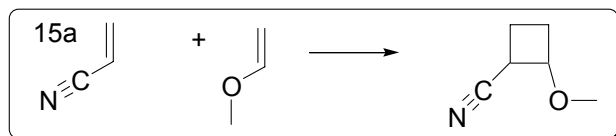
(5 pts) Are all of three of these MO's occupied? _____

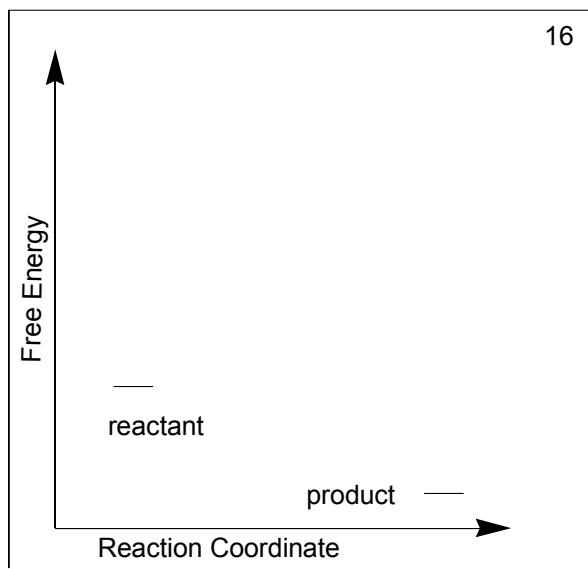
(6pts) How many more pi-molecular orbitals are there? _____

14. (10 pts) Draw a circle around the aromatic (unusually stable) molecules. Put an X through the unstable molecules.



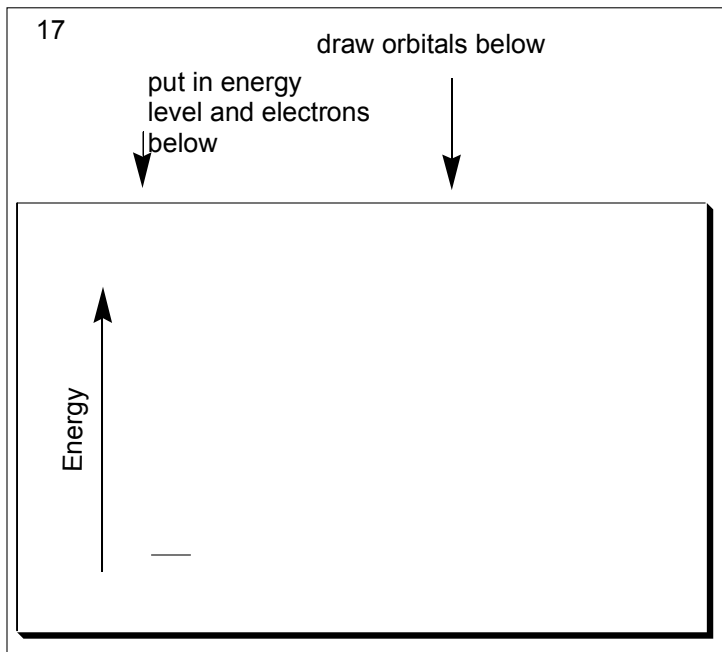
15. (10 pts) Think about the transition states of these two reactions. One readily happens the other does not. Explain why one occurs and the other does not in terms of aromaticity? For the brevity refer to the reactions as 15a and 15b.





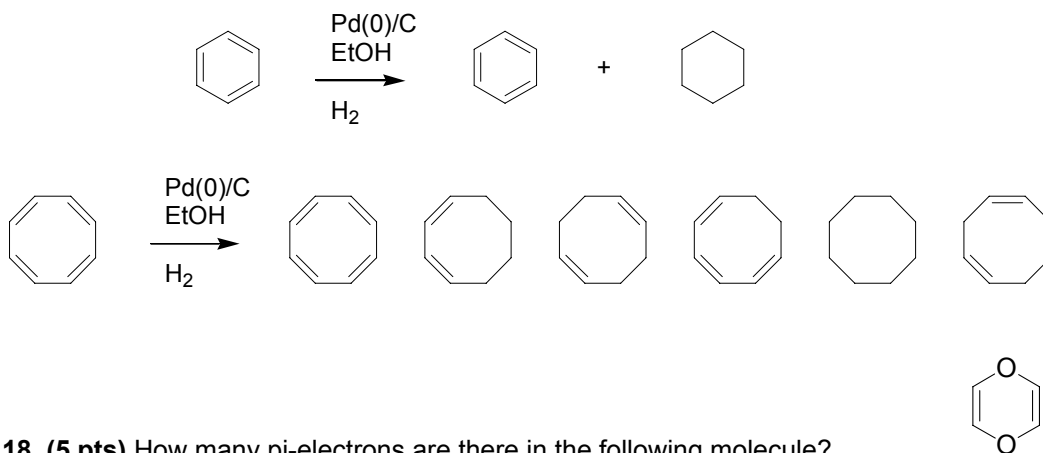
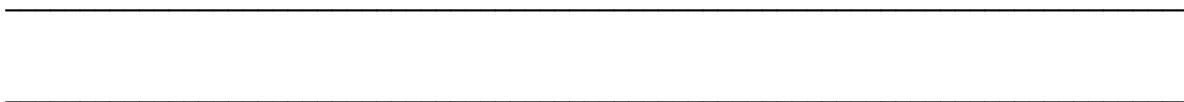
16. (5 pts) a. Complete the reaction energy diagram by using it to describe a reaction that has one intermediate. (6 pts) b. Use the ‡ sign to label the transition state(s). c. (4 pts) Would you expect that the reaction vessel gets warmer, colder or maintains the same temperature as the reaction occurs? _____

17. (10 pts) Use combinations of the orbitals of ethylene to construct the four molecular orbitals of butadiene. Label the orbitals X1-X4 with X4 being the highest energy MO. Again just look down on the pi-system from above and draw the orbitals as circles.



use the space above work #17.

18. (10 pts) Explain the following. In the hydrogenation of cyclooctatetraene dienes and trienes are isolated if the reaction is stop before completion. However only benzene and cyclohexane are observed in the incomplete hydrogenation of benzene. Why?



18. (5 pts) How many pi-electrons are there in the following molecule? _____

Work Space! This page must stay with your exam! You may refer the grader to this page for partial credit.

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