Massachusetts Institute of Technology
Organic Chemistry 5.13

Wednesday, October 25, 2006 Prof. Timothy F. Jamison

Hour Exam #2

Name _____

(please both **print** and **sign** your name)

Official Recitation Instructor _____

Directions: *Closed book exam, no books, notebooks, notes, etc. allowed. Calculators are **not** permitted for this exam. However, rulers and molecular model sets **are** permitted.*

Please read through the entire exam before beginning, in order to make sure that you have all the pages and in order to gauge the relative difficulty of each question. Budget your time accordingly.

Show all of your work if you wish to receive partial credit. You should have **8** pages total: **6** exam pages including this page and **2** blank pages for scratchwork.

Question:		**Grader:**
1. _____**/**	**14 points** (page 2)	_____
1. _____**/**	**16 points** (page 3)	_____
2. _____**/**	**48 points**	_____
3. _____/	**22 points**	
Total: _____**/**	**100 points**	_____

1. (30 points total, 2 points per box) In each box below, draw the structure of the **major** product of the reaction. **Indicate** relative **stereochemistry** where appropriate. If **no reaction** occurs, put a large **X** in the box. (Note: "D" = deuterium, ^2H)

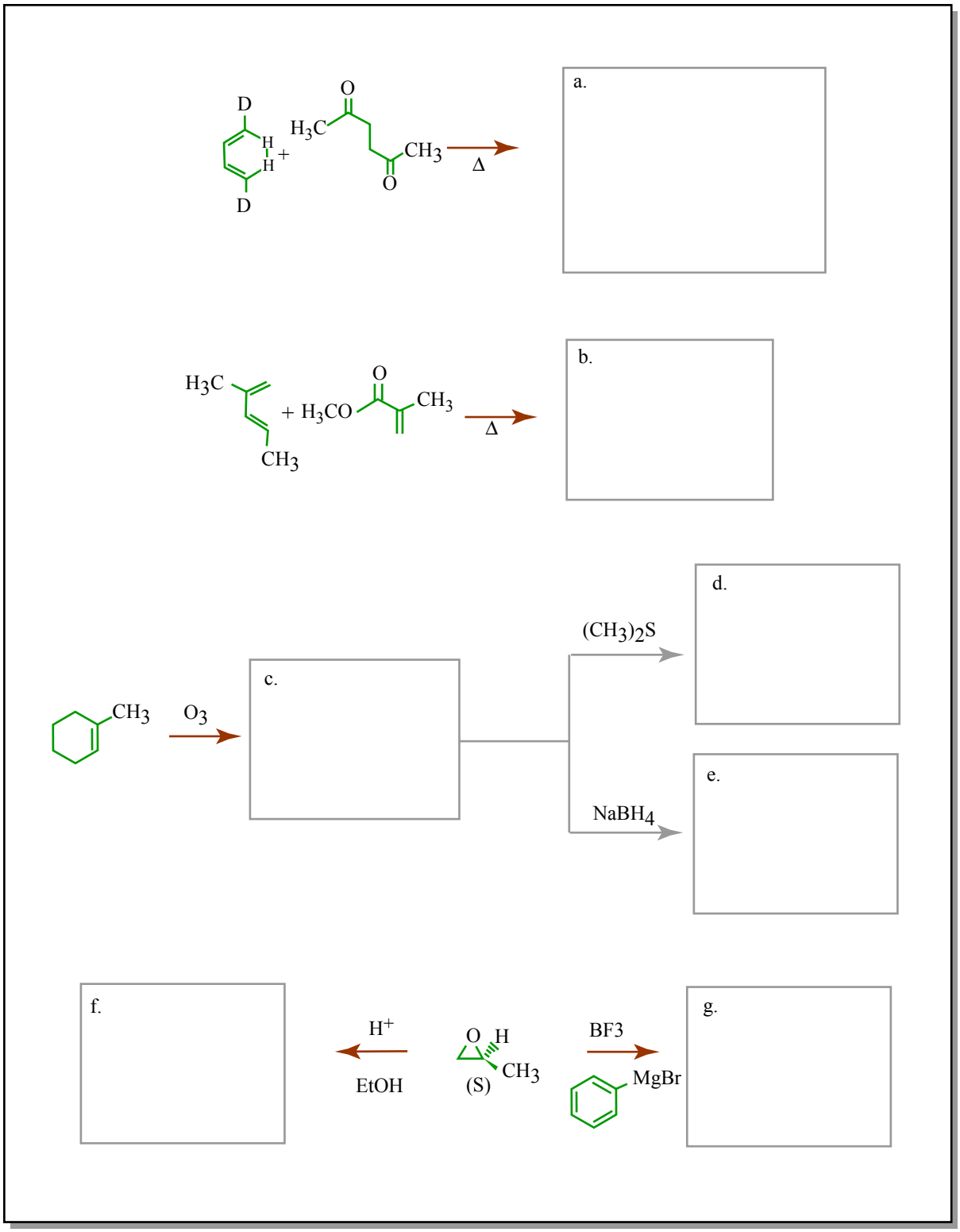


Figure by MIT OCW.

(1., continued – see previous page for directions)

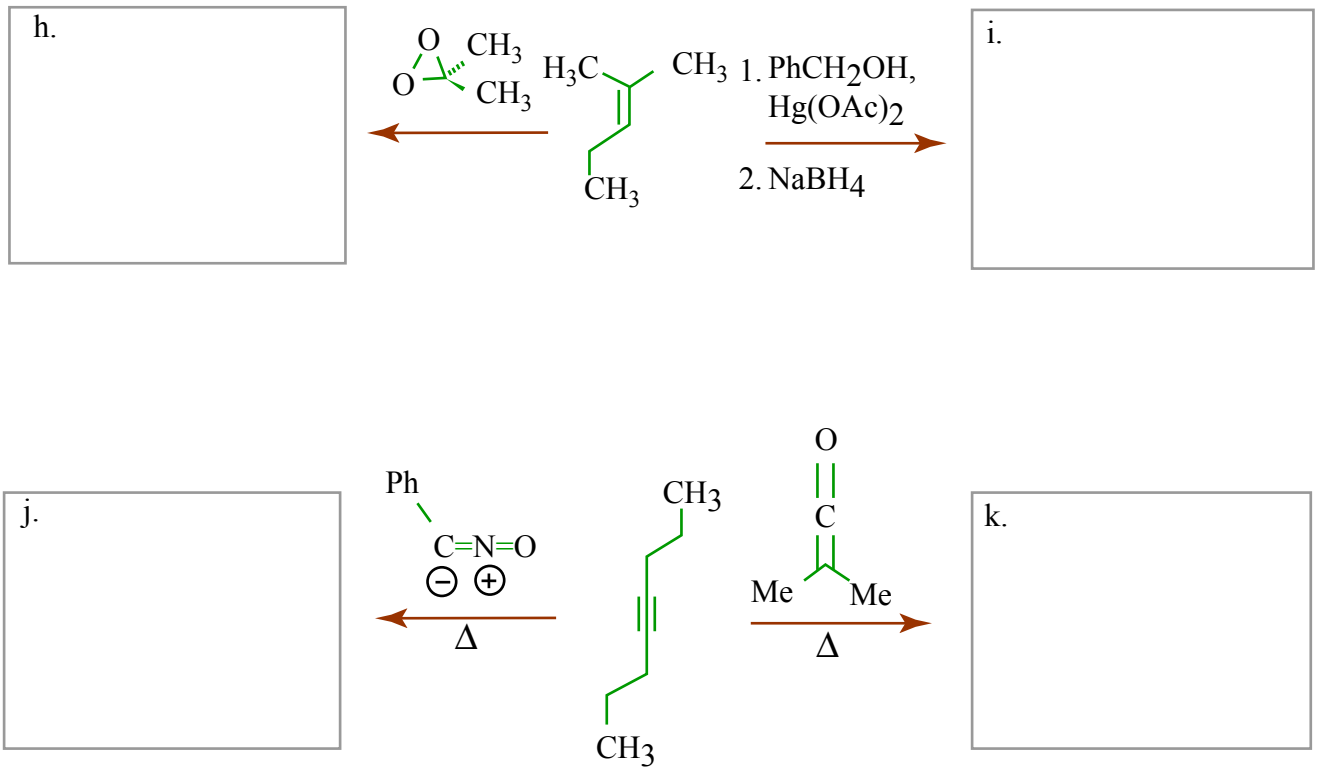


Figure by MIT OCW.

2. (48 points total)

a. **Draw** the **orbitals** (by shading the lobes appropriately) at each energy level for **1,3,5-hexatriene** (2 points each).

b. **Write** the **number of nodes** in the box to the left of each orbital array (1 point each).

c. For the ground state of 1,3,5-hexatriene, **draw** the **electron population** for each orbital on the line to the right of each orbital array. For each electron, clearly indicate whether it is "spin up" or "spin down". If there are no electrons in a given orbital, leave it blank (1 point each).

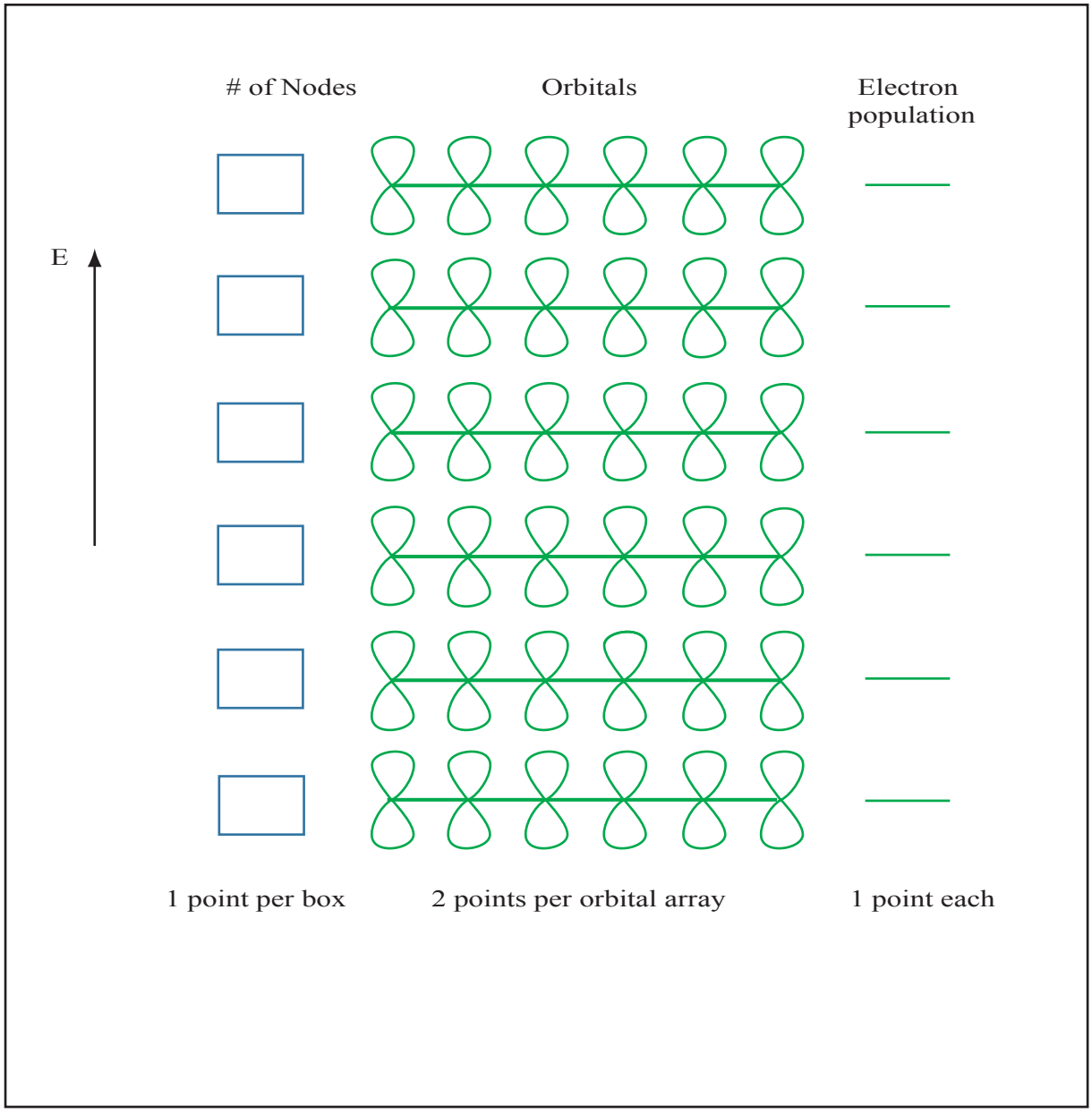


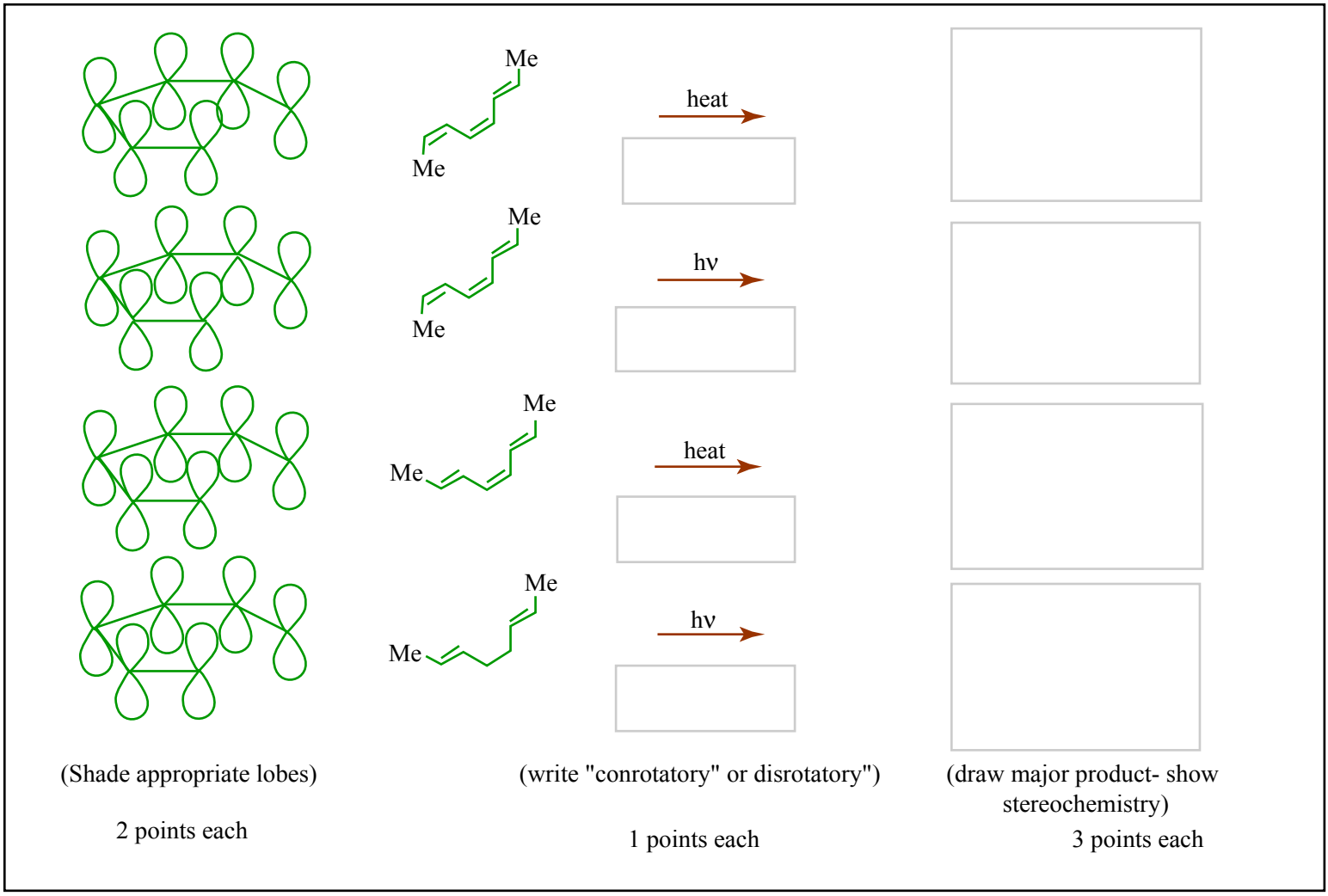
Figure by MIT OCW.

2. (continued)

d. For each reaction shown below, indicate which energy level is used to predict the stereochemical outcome by **shading the appropriate lobes of the entire orbital array**. (The methyl groups are omitted for clarity; you do not have to draw them.)

e. In the box under each reaction arrow, **write conrotatory** or **disrotatory**, as appropriate.

f. In the box to the right of each reaction arrow, **draw** the **major product** of the reaction, ***clearly*** **indicating the relative stereochemistry**.



(Shade appropriate lobes)

2 points each

(write "conrotatory" or disrotatory")

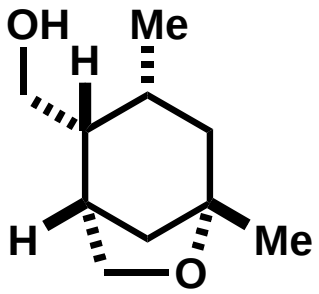
1 points each

(draw major product- show stereochemistry)

3 points each

Figure by MIT OCW.

3. (22 points total) Using retrosynthetic analysis, propose a synthesis of the molecule to the right (**A**). You may use any reagents you wish, as long as your **starting materials** and any other reagent that is used to install a **carbon** that is found in the final product (target molecule **A**) have **no more than 6 carbon atoms**. For example, 1,3-butadiene and benzene would be acceptable, but benzyl bromide ($PhCH_2Br$) would not be.



target molecule (**A**)

Write your synthesis in the "forward" direction, showing all steps and reagents necessary. (You may include solvents, but you are not required to do so.) **Draw a box around or circle your final synthesis.**

Hint: Use a Diels-Alder reaction.