

CHEMISTRY 3311, Fall 2003
Professor Walba
Third Hour Exam, November 20

scores:

- 1) 20
- 2) 20
- 3) 20
- 4) 30
- 5) 10

100

CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

Name (printed): _____ **Key**

Signature: _____

Recitation TA Name: _____

Recitation day and time: _____

This is a closed-book exam. The use of notes, models, calculators, and other paraphernalia will not be allowed during the exam. Please put all your answers on the test. Use the backs of the pages for scratch.

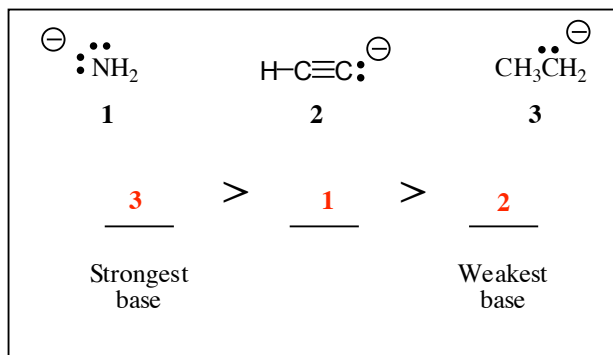
PLEASE read the questions carefully!

Partial Periodic Table

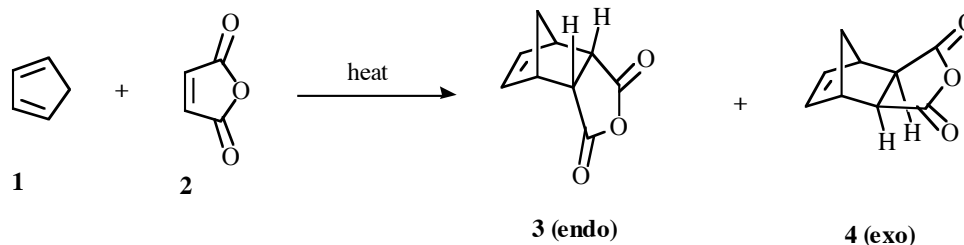
1A							8A
1 H							2 He
2A		3A	4A	5A	6A	7A	
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
							35 Br
							53 I

Name: _____

1) (20 pts) a) Arrange the following three anions in order of decreasing Bronsted basicity.

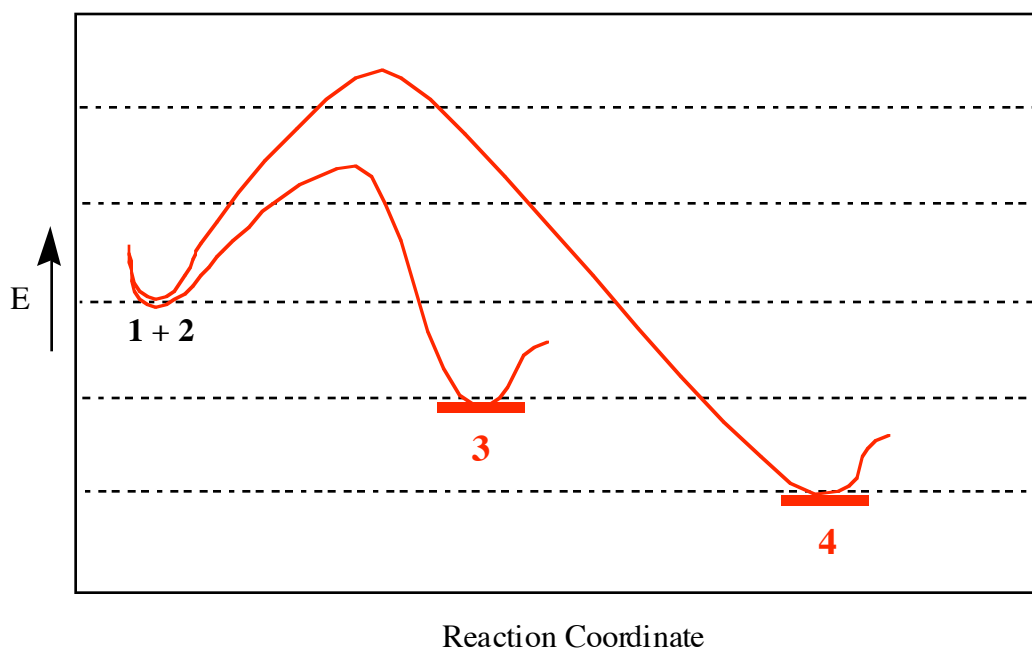


b) The reaction of cyclopentadiene (**1**) with maleic anhydride (**2**) is one of the most famous Diels Alder reactions. Two stereoisomeric products are formed, **3** and **4**, named the endo and exo products, respectively.



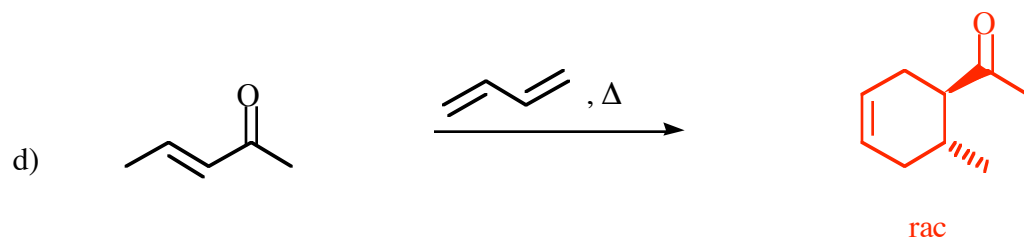
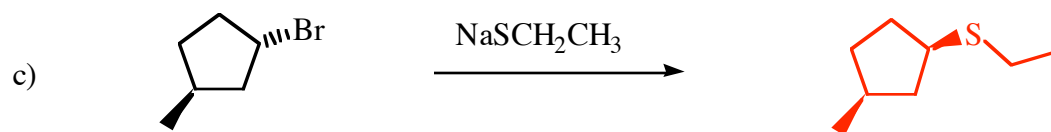
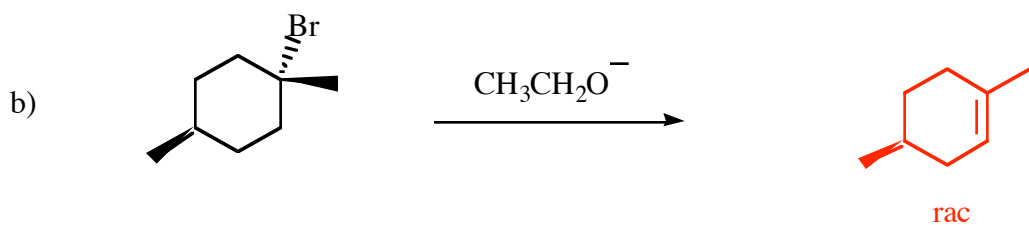
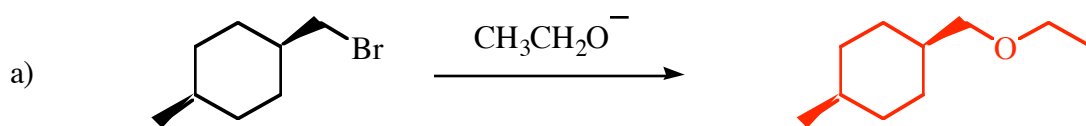
Given the following information, complete the energy diagram, carefully indicating the structure of each “well” using the numbers (**3** and **4**). There is no need to label the transition states, but be sure to complete the diagram in such a way that it's clear which product came from which transition state.

- Both products **3** and **4** are more stable than the starting materials.
- At low temperature the reaction is irreversible (kinetic conditions), and product **3** is the major product.
- At high temperature the reaction is reversible (thermodynamic conditions), and product **4** is the major product.



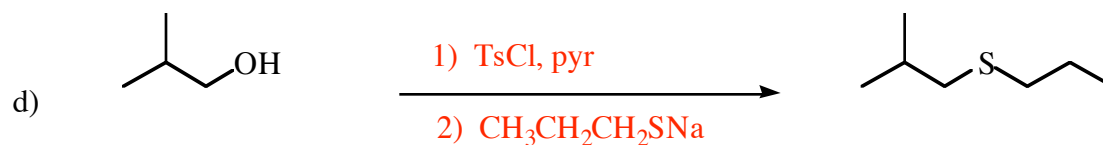
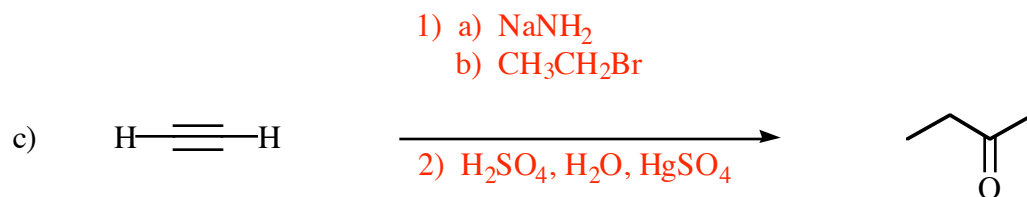
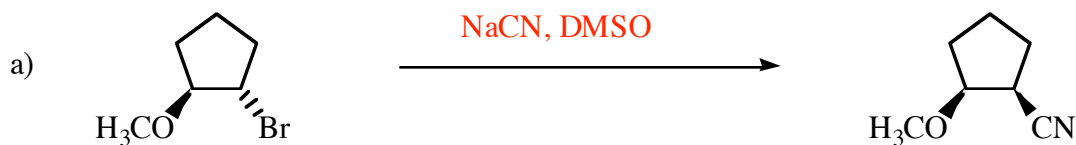
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2) (20 pts) Give the single major organic product of each of the following reactions. Carefully indicate the stereochemistry of the product if appropriate. If a racemate is formed, show only one enantiomer, and label it "rac."



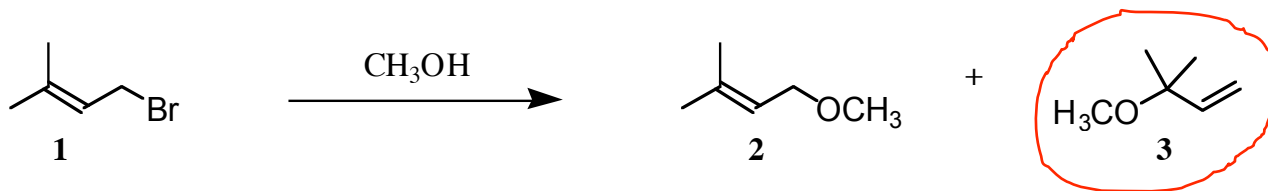
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3) (20 pts) Propose reagents for accomplishing the following transformations. NOTE: more than one step may be required! Try to make your synthesis efficient (i.e. the desired product should be the major product). You must use the starting material given; you may use any other reagents you need.



Name: _____

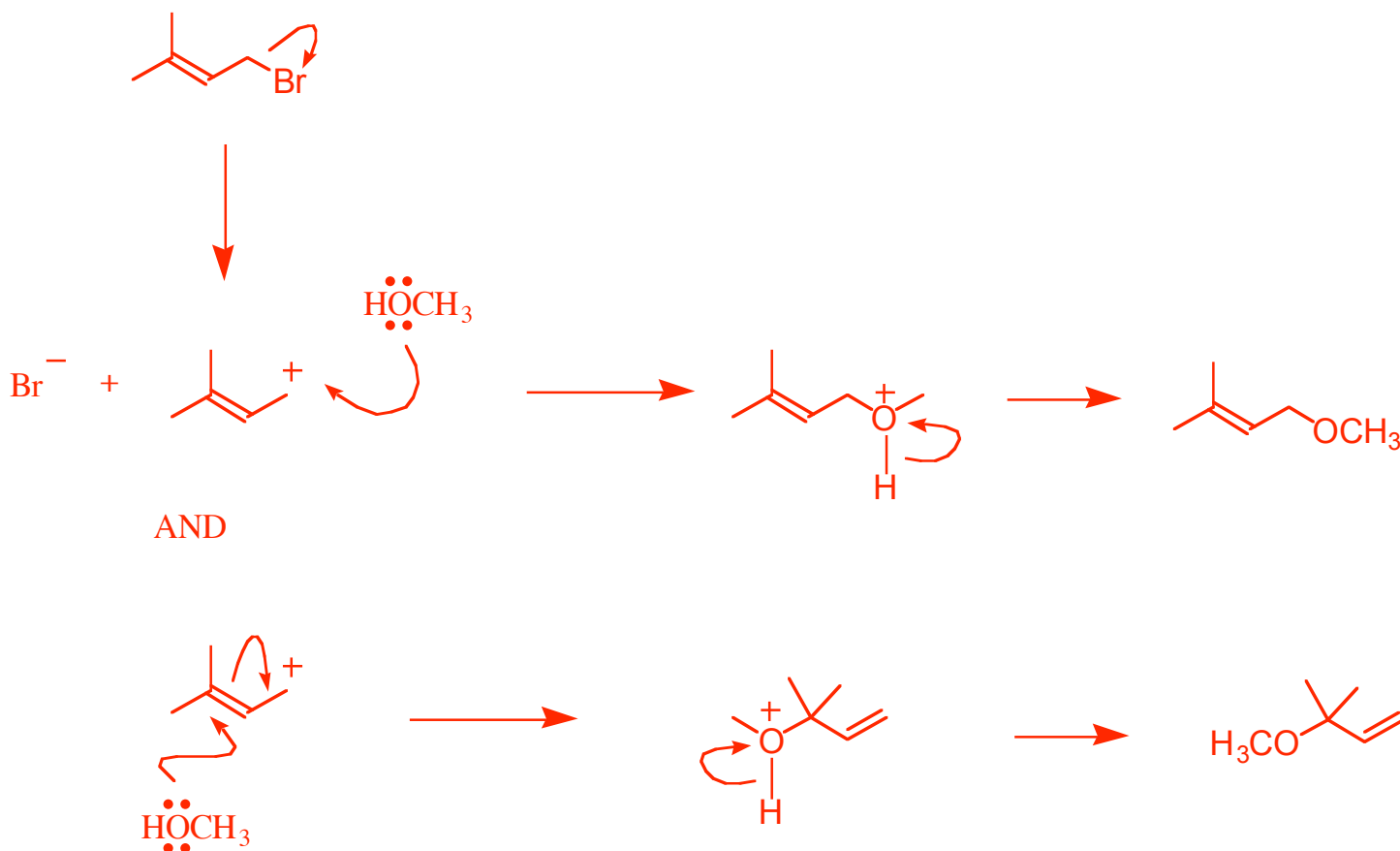
4) (30 pts) When the bromide **1** is dissolved in methanol, the ethers **2** and **3** are formed. It can be shown that the reaction is irreversible.



a) What is the name of the mechanism for this transformation? **S_N1**

b) Circle the major product of this reaction.

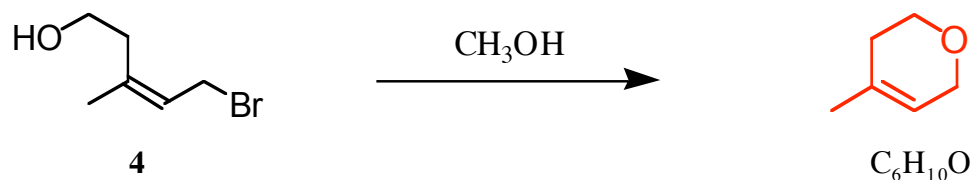
c) Propose an arrow-pushing mechanism for the formation of ethers **2** and **3**. In your mechanism, be sure to show each intermediate using valid valence-bond formulas.



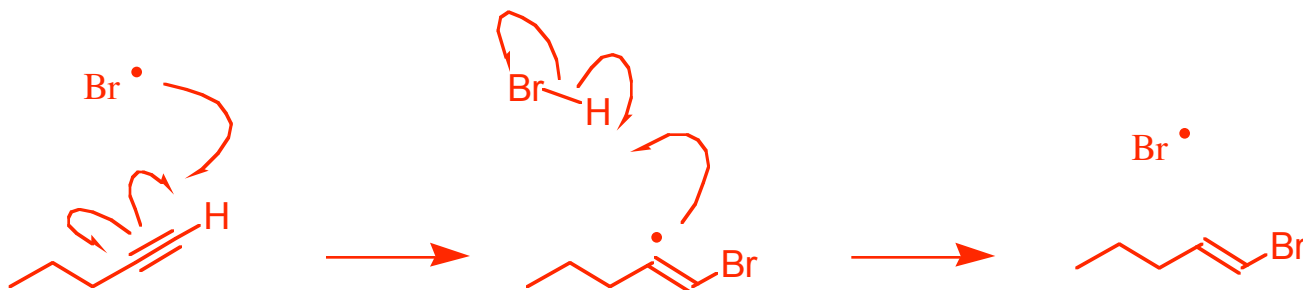
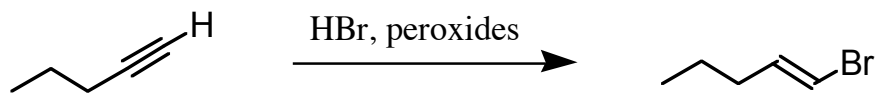
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4 –continued-

d) When the bromide **4** is dissolved in methanol, a new product is formed in high yield. This product has no OCH_3 groups, and only one double bond (!). The molecular formula of the mystery product is $\text{C}_6\text{H}_{10}\text{O}$. For five bonus points, give the structure of the product of this transformation.



e) Propose an arrow-pushing mechanism for the chain propagation steps for following transformation. Please show only the chain propagation steps in your mechanism.



Name: _____

5) (10 pts) Propose a synthesis for the following target using any organic starting materials with FIVE carbons or less, and any inorganic reagents you need. Try to make your synthesis efficient (that is, the desired product in each step should be the major product).

