

Name: \_\_\_\_\_ Key \_\_\_\_\_

CHEMISTRY 3311, Fall 1998  
Professor Walba  
Second Hour Exam  
October 22, 1998

scores:

- 1)
  - 2)
  - 3)
  - 4)
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This is a closed-book "open model" exam. You may use models, but no notes or books. Please put all your answers on the test. Use the backs of the pages for scratch.

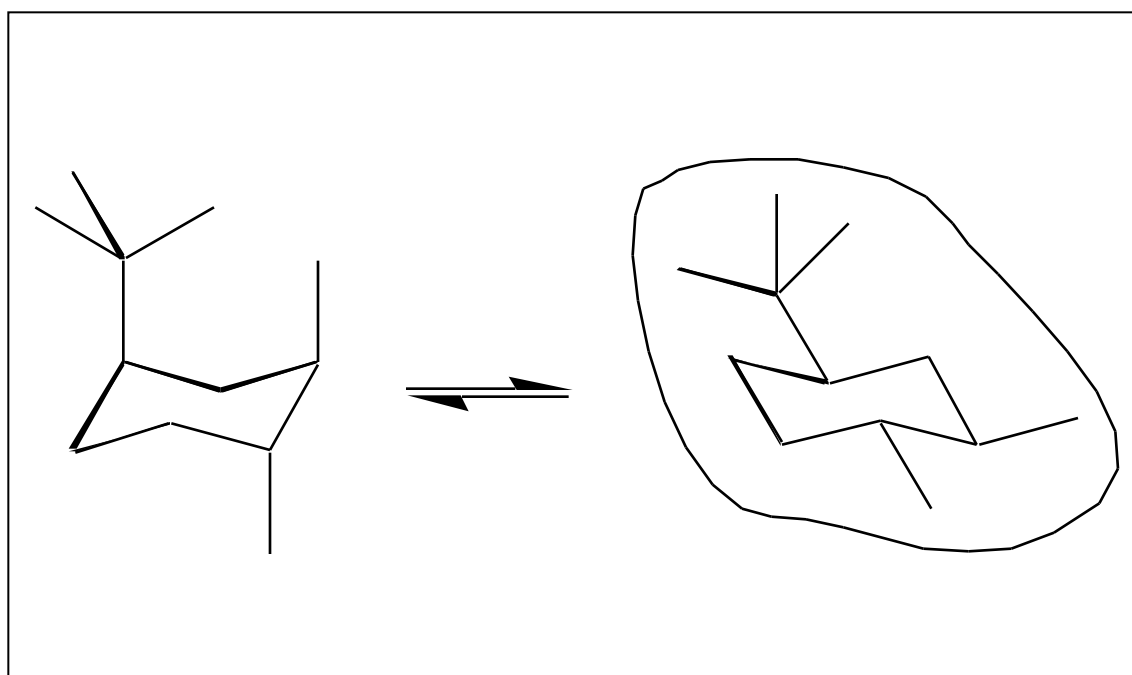
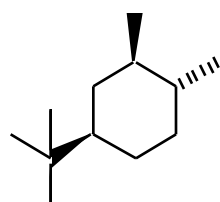
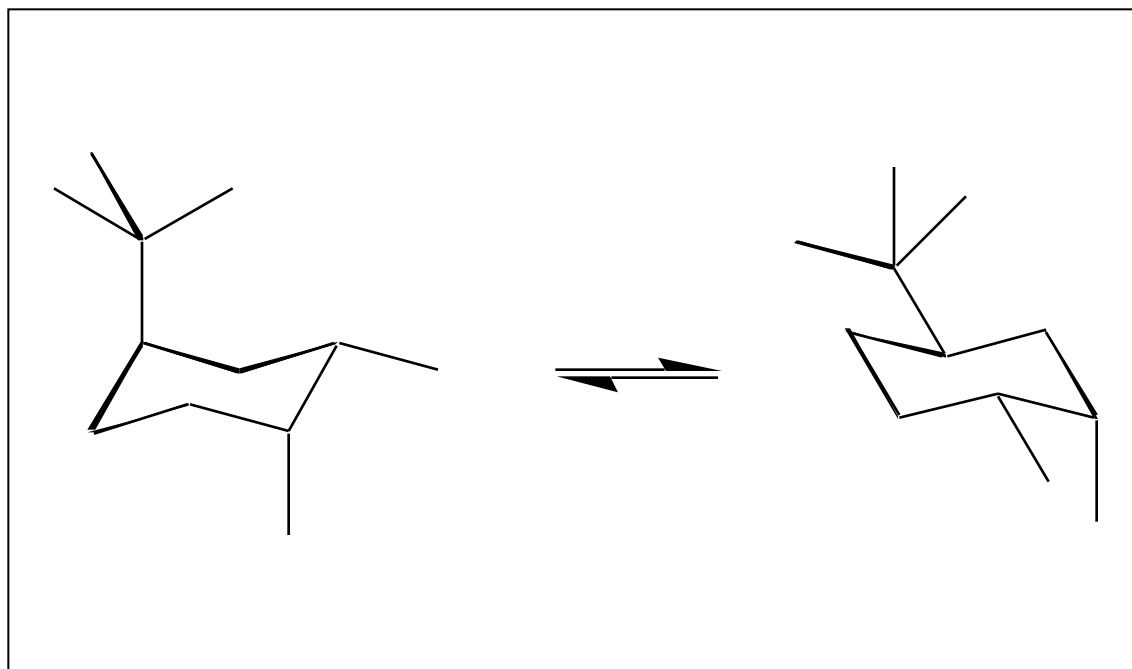
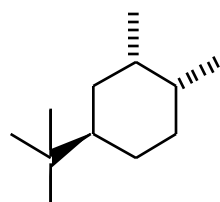
**PLEASE read the questions carefully!**

### Partial Periodic Table

		1 H							8A 2 He	
1A      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			

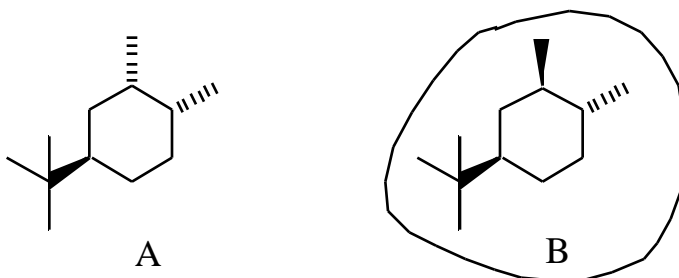
Name: \_\_\_\_\_ Key \_\_\_\_\_

1) (30 pts) For the following substituted cyclohexane isomers, carefully draw the two possible chair conformations for each isomer (that means you should have four perspective chair structures drawn, two equilibrating structures in each box). Of course you need to put the methyl and tert-butyl groups on the structures, but please do not put in the H atoms. For each pair of conformations, circle the more stable one. If the two conformations have the same energy, label that pair "same".



1 -continued-

b) The same isomers from part a) are reproduced below. Circle the more stable compound below.



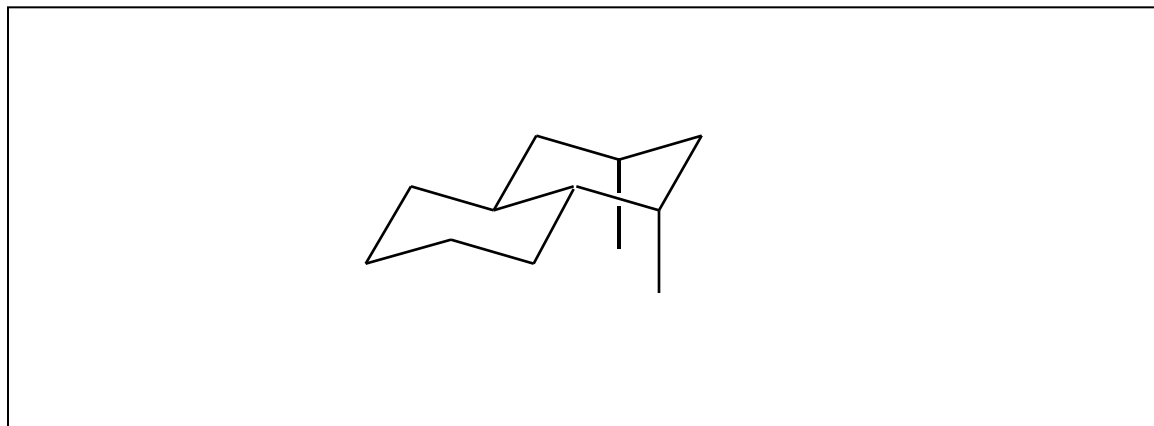
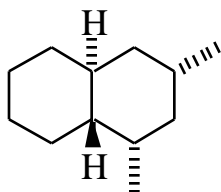
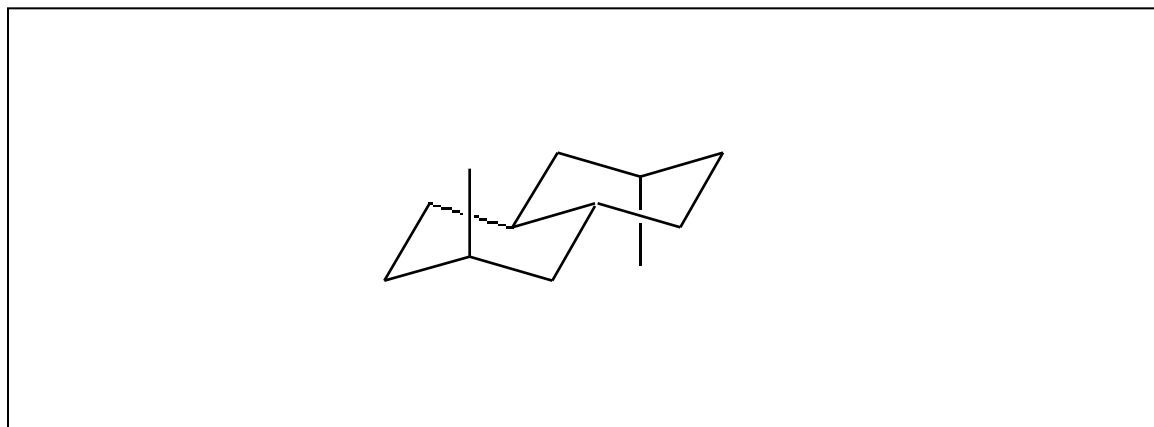
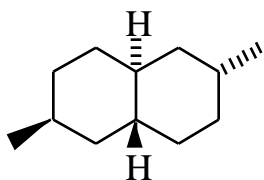
c) If one burns compound A (combustion), then a lot of heat is produced. If one burns compound B, a different amount of heat is produced. Which compound gives more heat of combustion?

Compound A gives a higher heat of combustion.

d) Estimate, in units of "gauche butane interactions," the magnitude of the difference in heats of combustion of A and B.

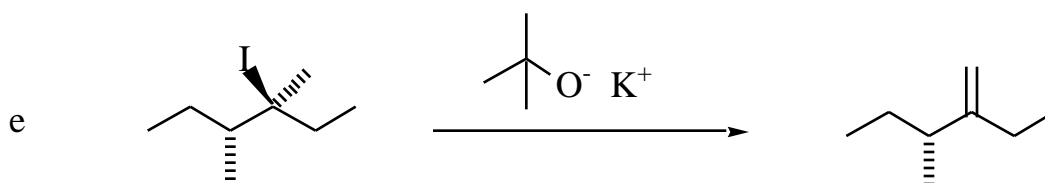
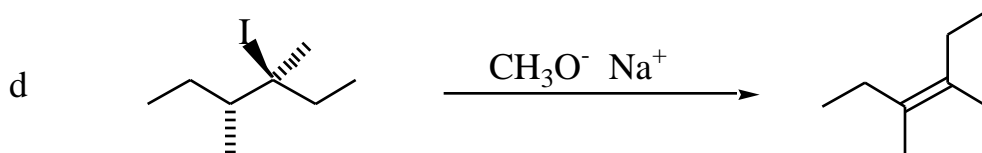
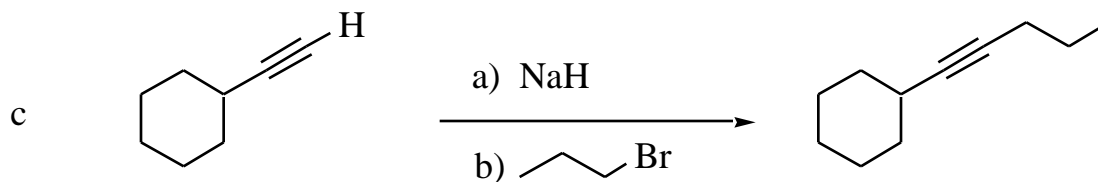
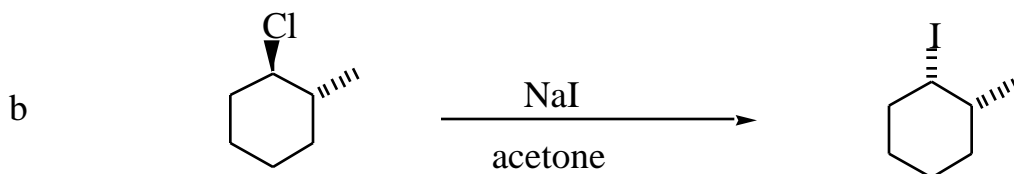
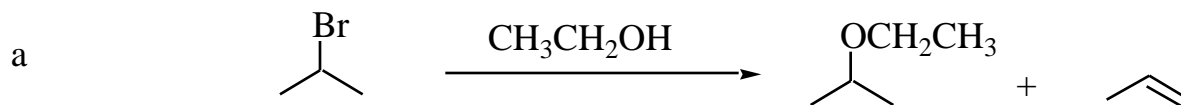
Two gauche butane unites

e) Draw one perspective chair picture for each of these substituted decalin isomers. **CIRCLE THE MORE STABLE ISOMER.**



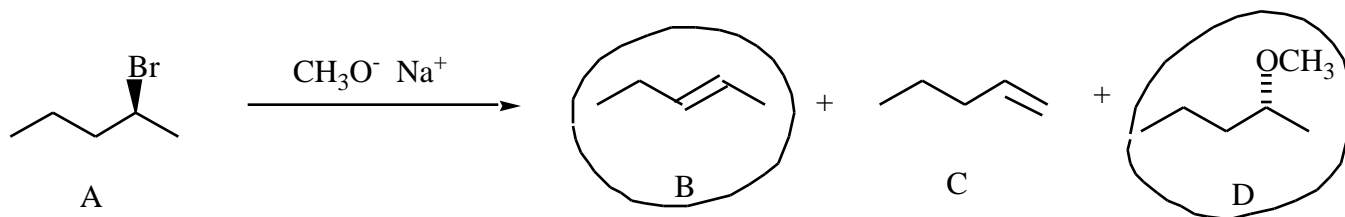
Name: \_\_\_\_\_ Key \_\_\_\_\_

2) (25 pts) Give the single major product of each of the following reactions. If two major products are formed, give the structure of both major products. Show the stereochemistry of the product(s) using wedges and dashes if appropriate.



Name: \_\_\_\_\_ Key \_\_\_\_\_

3) (30 pts) The reaction of (S)-2-bromopentane (A) with ammonia gives TWO major products and a minor product.



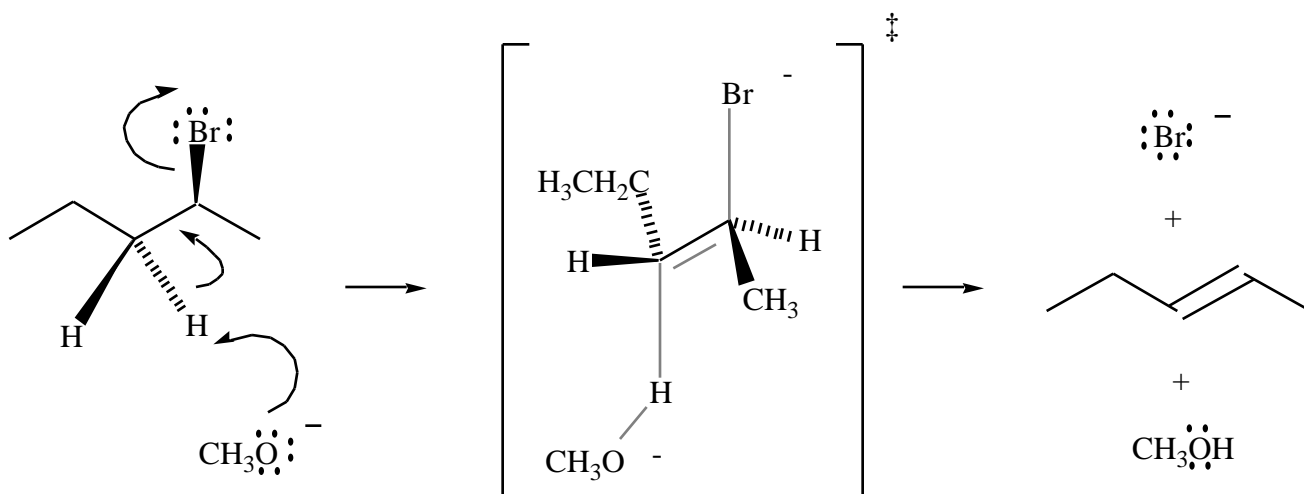
- a) Circle the two major products of this reaction.  
 b) Name the mechanisms that lead to these products below.

Mechanism leading to product B is: E2

Mechanism leading to product C is: E2

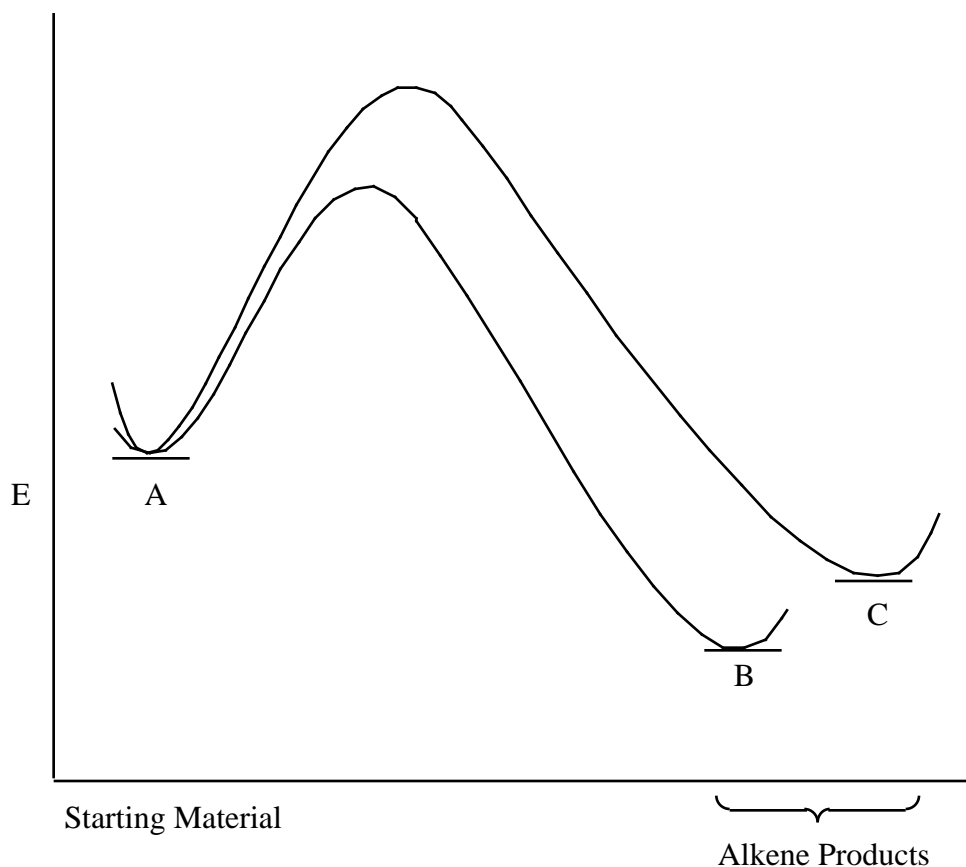
Mechanism leading to product D is:  $\text{S}_{\text{N}}2$

- c) Using WEDGES AND DASHES structures, carefully draw an arrow-pushing mechanism AND THE TRANSITION STATE for the formation of product B.



3 - continued -

d) Referring to the reaction of question 3, complete the energy diagram below. BE SURE to label the two alkene products (B and C) on the diagram (don't draw any structures on the diagram). DO NOT draw structures for the transition states, but be sure to show the relative energies of the transition states leading to the two products.

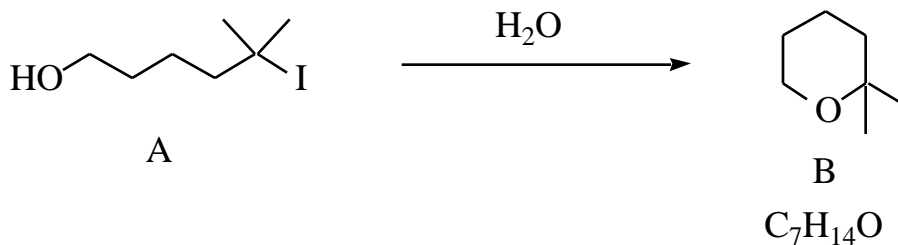


d) Referring to the reaction of question 3, if one starts with RACEMIC 2-bromopentane (racemic A), then the ether D is formed as a racemate. In this context, give a one sentence explanation of what RESOLUTION means.

Resolution means the process of separating the two enantiomers of racemic ether D.

Name: \_\_\_\_\_ Key \_\_\_\_\_

4) (15 pts) a) Treatment of iodide A with water gives a product B with no iodine atom. Amazingly, it also has no OH groups! Propose a structure for product B, which has molecular formula  $C_7H_{14}O$



b) Propose an arrow-pushing mechanism for the formation of product B.

