

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

CHEMISTRY 3311, Fall 2002  
Professor Walba  
First Hour Exam, September 26

scores:

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

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.

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100

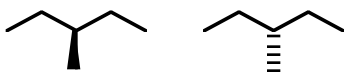
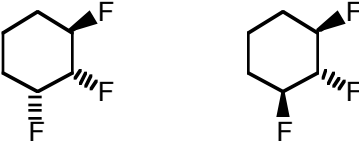

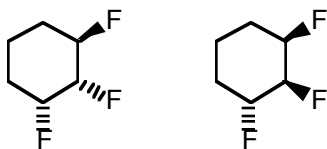
PLEASE read the questions carefully!

## Partial Periodic Table


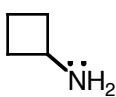
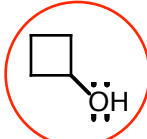
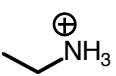
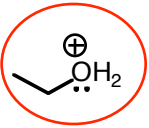

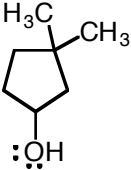
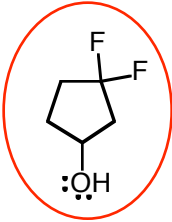
1A							8A
1 H						2 He	
	2A						
3 Li	4 Be	3A	4A	5A	6A	7A	10 Ne
		5	6	7	8	9	
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
						35 Br	
						53 I	

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1 (20 pts) a) Describe the relationship between each of the following pairs of structures using one of the following pairwise descriptors: homomers; constitutional isomers; stereoisomers.

 <p style="text-align: center; color: red;">homomers</p>	 <p style="text-align: center; color: red;">stereoisomers</p>
 <p style="text-align: center; color: red;">constitutional isomers</p>	 <p style="text-align: center; color: red;">homomers</p>

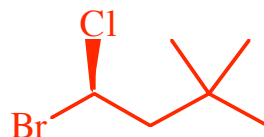
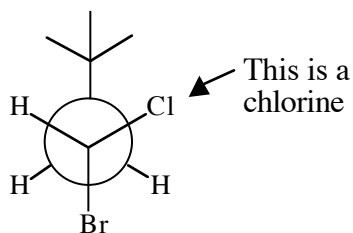
b) Each of the following pairs of compounds can in principle act as a Bronsted acid (i.e. can donate a proton to a base). For each pair, circle the stronger acid.

 <p style="margin-left: 100px;"><math>\text{CH}_4</math></p>	 
<p>iii</p>  	 <p style="margin-left: 100px;"><math>\text{HF}</math></p>
 	

c) In ONE WORD, give a reason for your answer in part 1.b.iii. **Electronegativity**

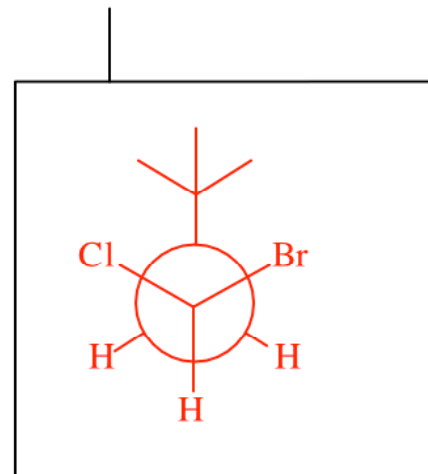
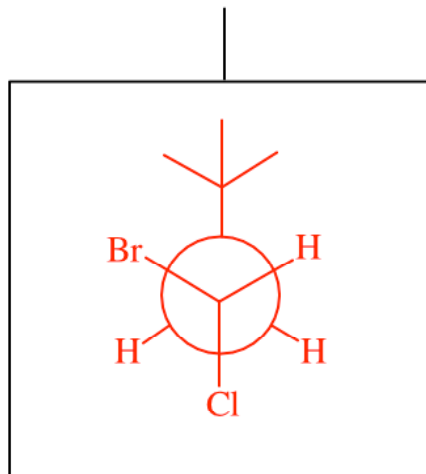
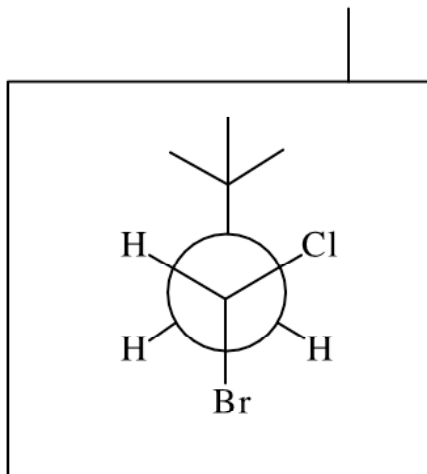
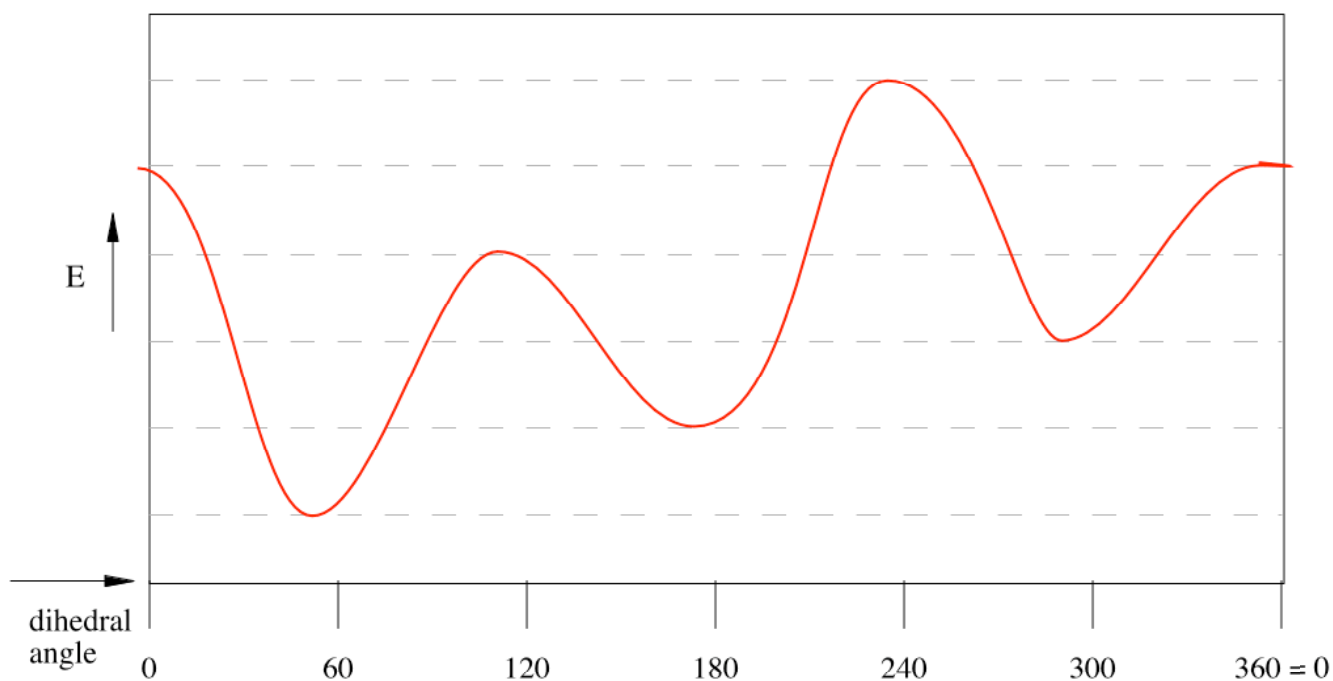
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2) (20 pts) a) Draw a wedges and dashes structure for the conformation of 1-bromo-1-chloro-3,3-dimethylbutane shown in the Newman projection below.



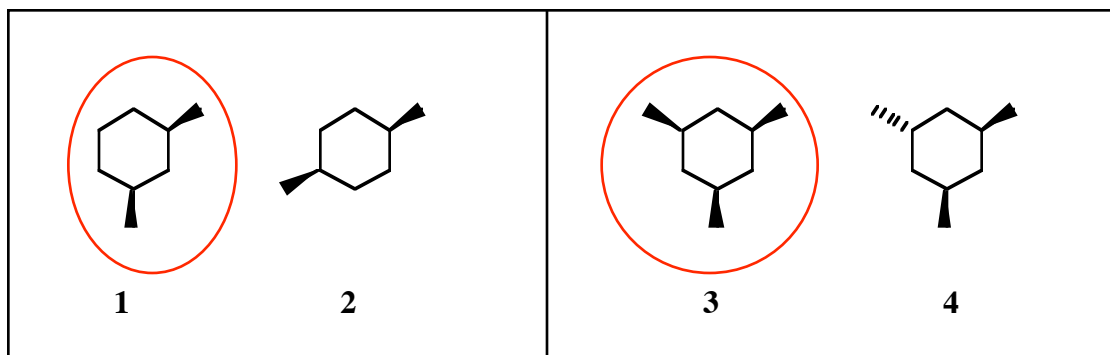
Dihedral angle for Cl-C(1)-C(2)-C(3) =  $60^\circ$

b) Sterically, a bromine atom is bigger than a chlorine (the van der Waals diameter of bromine is about  $2.3 \text{ \AA}$ , and the diameter of chlorine is only  $2.0 \text{ \AA}$ ). Complete the conformational energy diagram below for rotation about the C(1)-C(2) bond (please rotate the **front** carbon (C1)). Define the  $60^\circ$  dihedral angle as the conformation shown above. Be sure to carefully indicate the relative energy of each well and barrier in your energy diagram, and complete the Newman projections for the  $180^\circ$  and  $300^\circ$  conformations.



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3) (20 pts) a) For each pair of isomers in the boxes below, circle the more stable isomer.

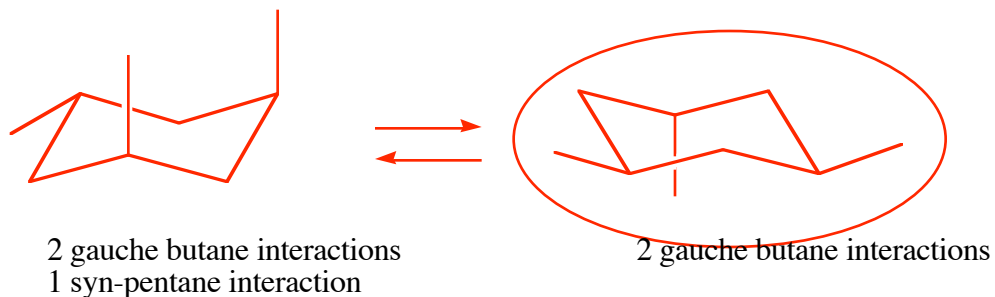


b) Draw the two flip-chair conformations of compound **4** below.

c) Circle the more stable conformation.

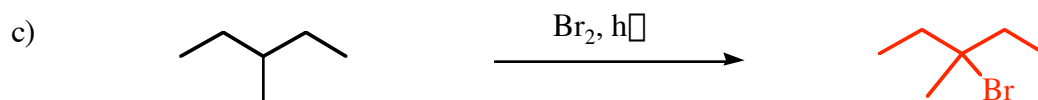
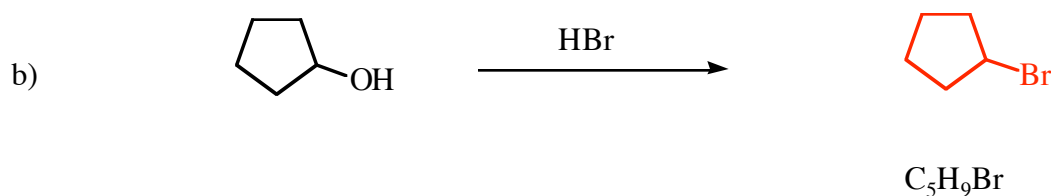
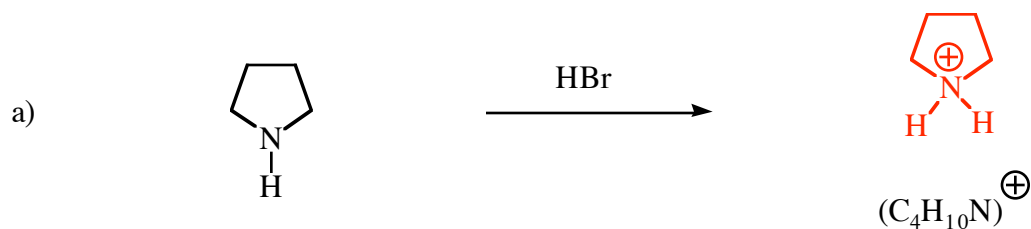
d) Indicate in writing with a numbers (not on the structures) how many gauche butane (1,3-diaxial Methyl-H) interactions, and how many syn-pentane (1,3-diaxial Methyl-Methyl) interactions each conformation has. That is, for each flip chair form of compound **4**, you should write “x gauche butane interactions” and “y syn-pentane interactions” where x and y are the correct numbers.

e) DON'T FORGET TO DO PARTS 3C AND 3D!!!

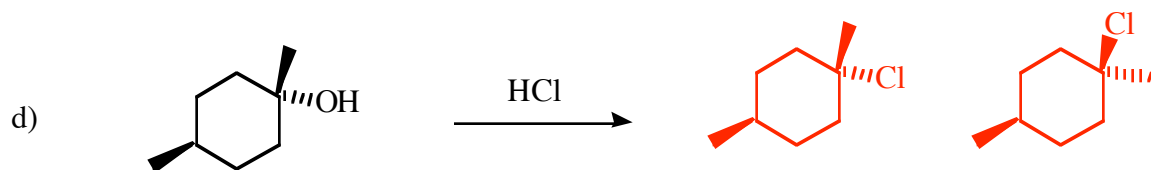


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4) (20 pts) Give the structure of the **single major organic product** formed from each of the following reactions. Each structure should be a valid valence bond structure, showing lone pairs and correct formal charges on all the atoms (of course, if the formal charge on an atom is 0, then you don't show it).

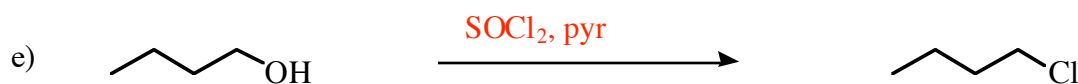


The following reaction gives two major products! Draw structures for these two products.

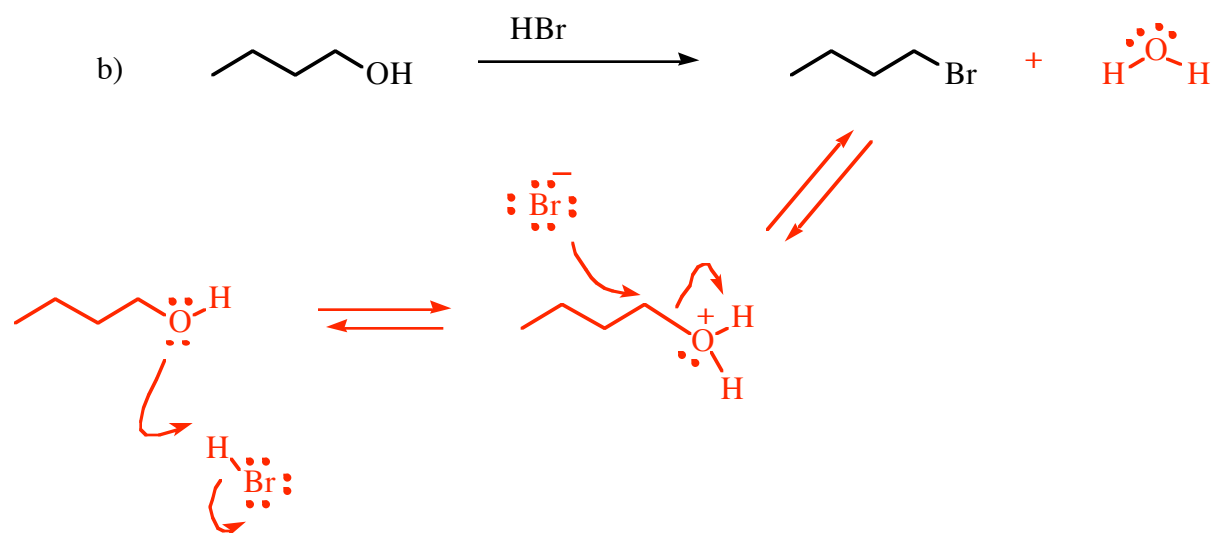
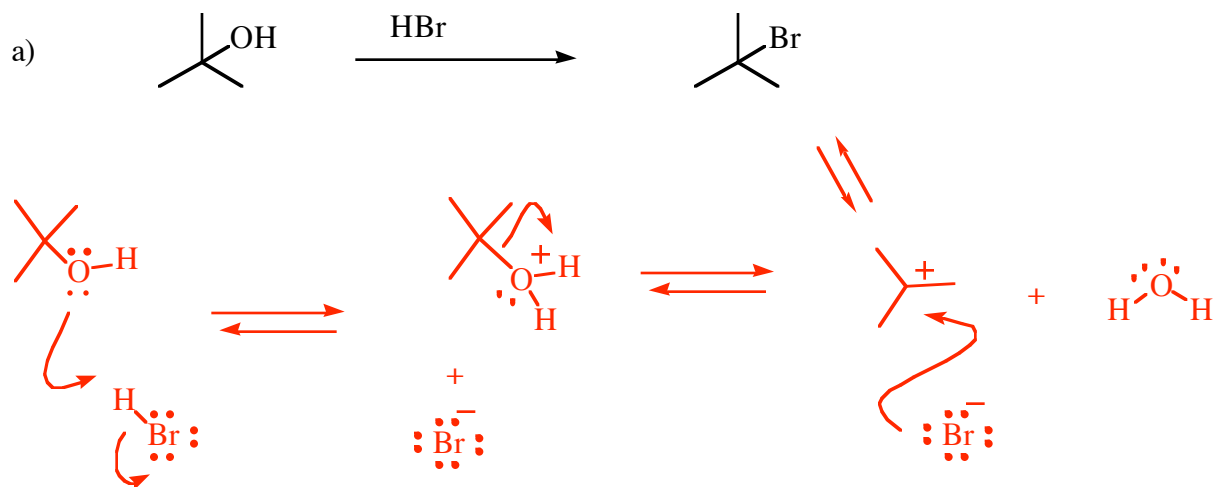


TWO major products with MF = C<sub>8</sub>H<sub>15</sub>Cl

Propose reagents for accomplishing the following transformation.

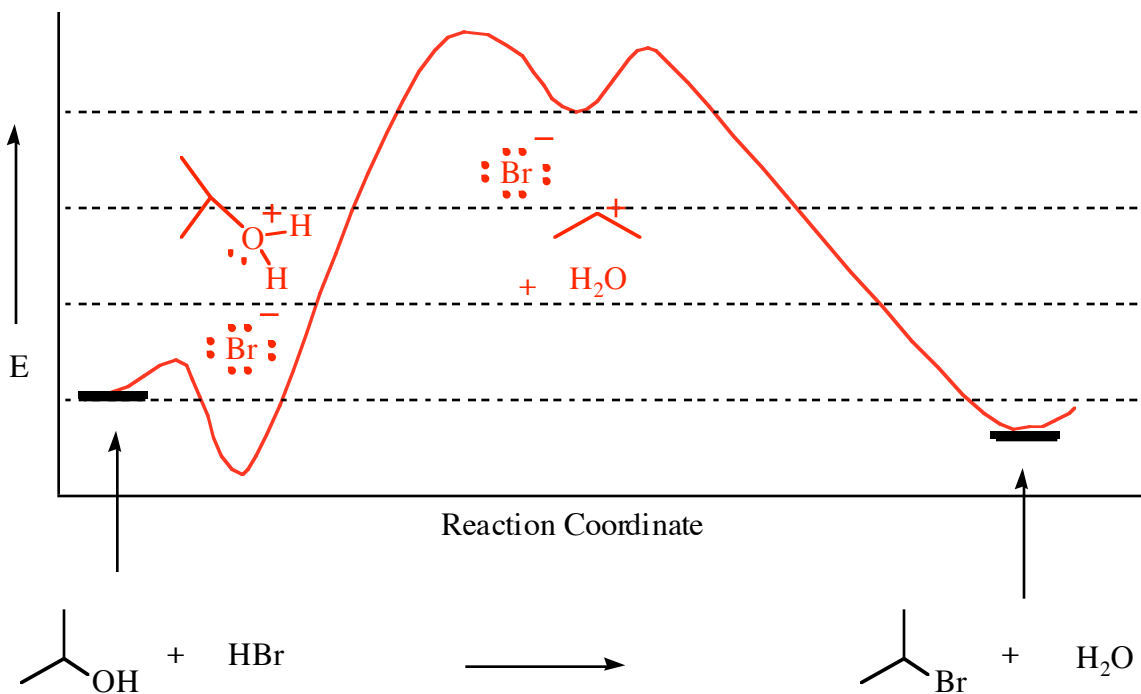
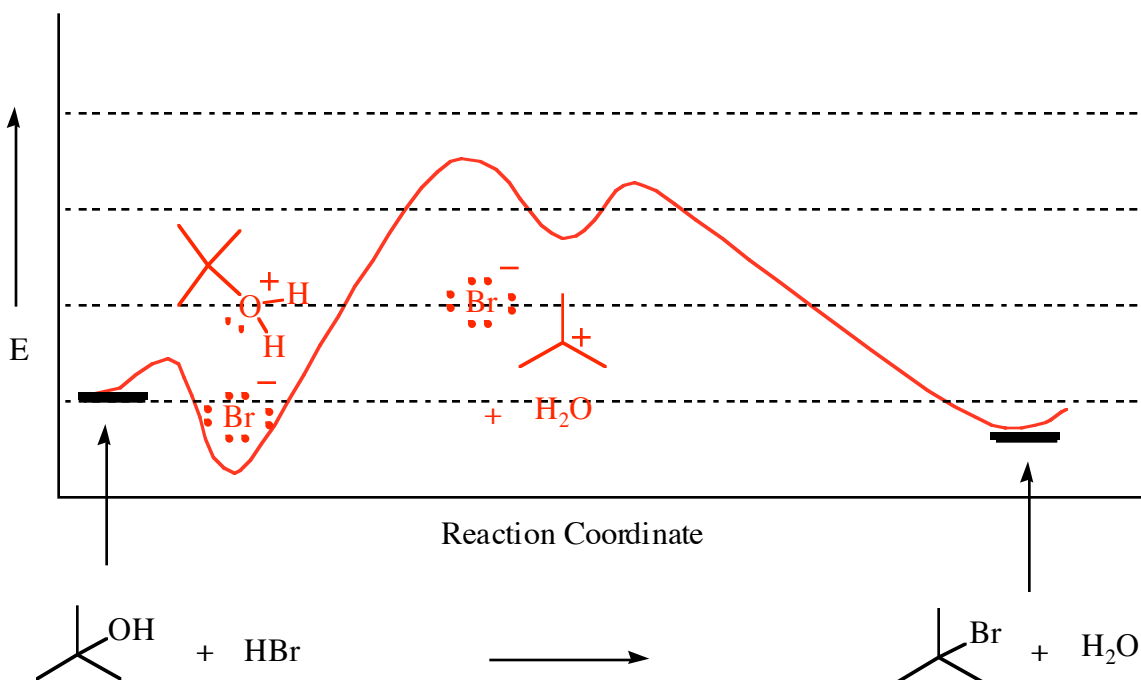


5) (20 pts) Propose arrow-pushing mechanisms for each of the following transformations. Be sure to show valid valence bond structures (with lone pairs and formal charges) for each intermediate in your mechanisms, but please do not show transition states.



5 –continued–

- c) For the two reactions indicated below, complete the energy diagrams, carefully showing the relative energy of each intermediate and transition state. Please assume that the energy scale is the same in each diagram, in order to indicate the relative energies of the transitions states for the two different reactions. Indicate a valid valence bond structure for each intermediate (do not show the actual structures of the transitions states).



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5 –continued-

d) For four points, propose a structure for the product of the following reaction.

