

CHE 230 001  
Organic Chemistry 1  
Exam 2  
October 21, 2013

Name: **KEY**

Student number:

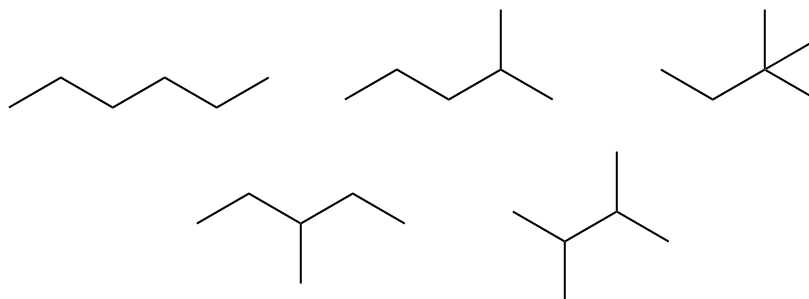
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***Before you begin this exam:*** **First:** You are allowed to have a simple model set at your seat. Please put away all other materials. Calculators will not be needed. **Second:** Place your student identification on your desk. A proctor will come around to check everyone's ID. **Third:** 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 others that look easy. **Fourth:** READ EACH QUESTION CAREFULLY. Be sure you answer the question that is asked. **Fifth:** This exam must be turned in by 8:50 AM SHARP. There will be no extensions, so budget your time carefully.

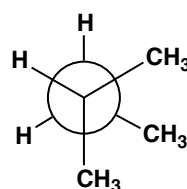
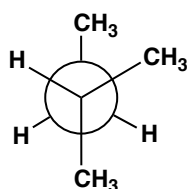
1. 8 points \_\_\_\_\_
2. 6 points \_\_\_\_\_
3. 8 points \_\_\_\_\_
4. 12 points \_\_\_\_\_
5. 8 points \_\_\_\_\_
6. 8 points \_\_\_\_\_
7. 8 points \_\_\_\_\_
8. 8 points \_\_\_\_\_
9. 8 points \_\_\_\_\_
10. 8 points \_\_\_\_\_
11. 12 points \_\_\_\_\_
12. 6 points \_\_\_\_\_
  
- 100 points \_\_\_\_\_

1. (8 points) Draw 4 different skeletal isomers with molecular formula  $C_6H_{14}$ .

*There are more than 4 possibilities here. Here are some that come to mind.*

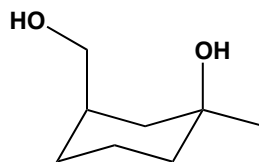
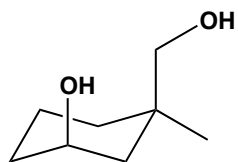


2. (6 points) Which conformation below is **lower** in energy? (circle one)

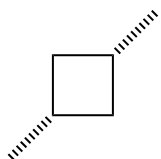
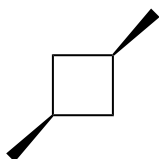


*This one*

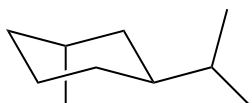
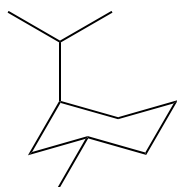
3. (8 points) For each pair of compounds below, indicate whether they are *structural isomers* (also known as skeletal or constitutional isomers), *stereoisomers*, *conformational isomers*, or *identical*. Write your answer in the space provided.



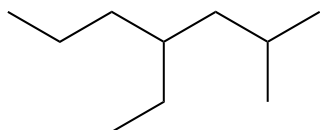
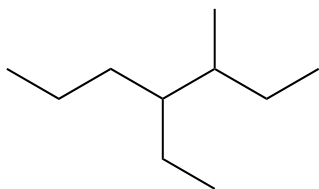
structural



identical

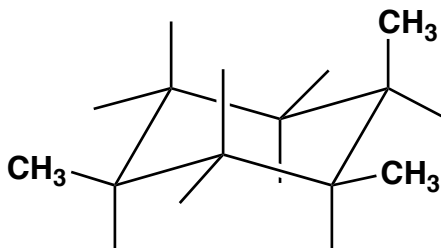
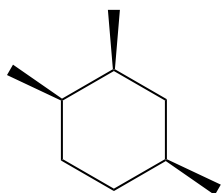
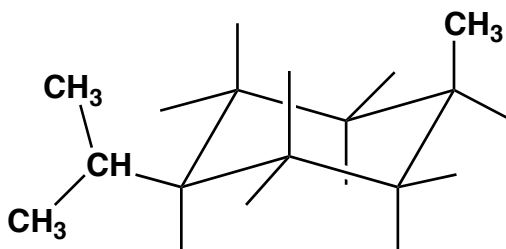
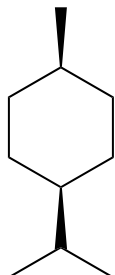
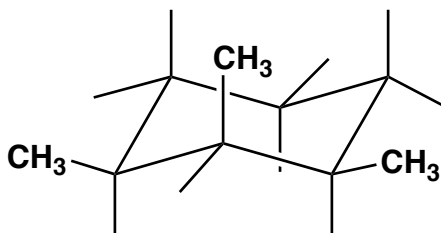
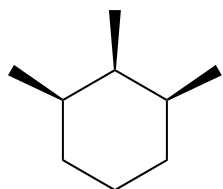


conformational

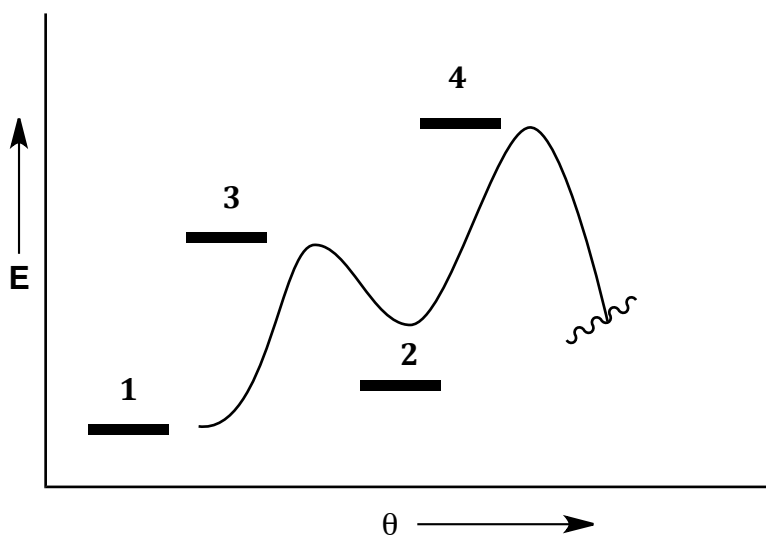
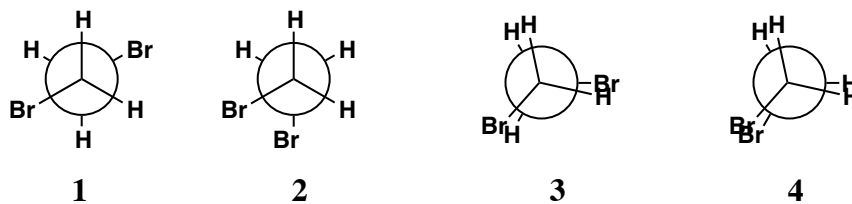


structural

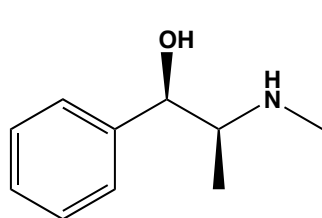
4. (12 points) Draw the following compounds in their MOST STABLE chair conformation. Use the template provided - simply add the correct substituents in the correct positions and orientations.



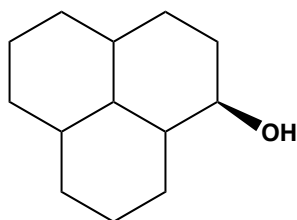
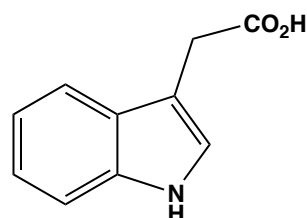
5. (8 points) Shown below are four numbered Newman projections for 1,2-dibromoethane and a rotational energy profile diagram. At each energy minimum and maximum on the diagram, write in the number of the Newman projection that corresponds to that energy.



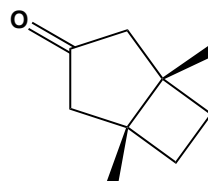
6. (8 points) Which of the following compounds are chiral? Circle the *chiral* structures.



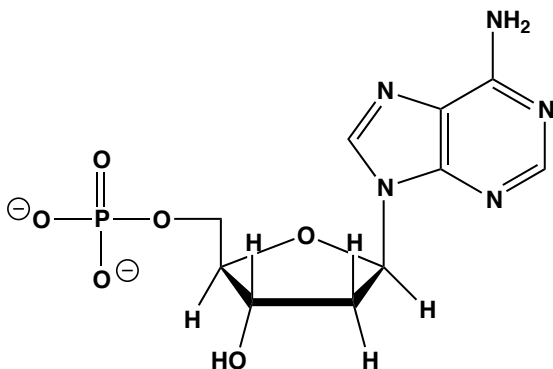
*chiral*



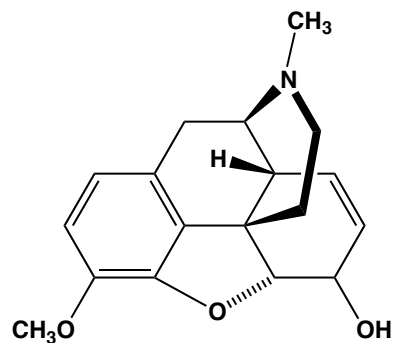
*chiral*



7. (8 points) How many tetrahedral stereogenic centers are there in the compounds below:

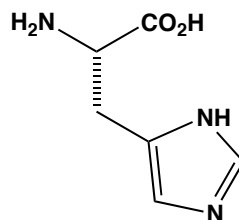
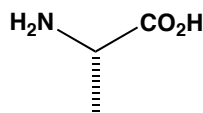


3



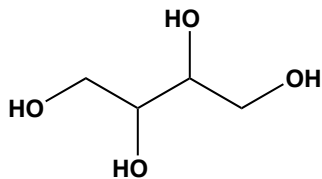
5

8. (8 points) Determine the absolute stereochemistry (*R* or *S*) at the (single) stereogenic center in each of the following amino acids.

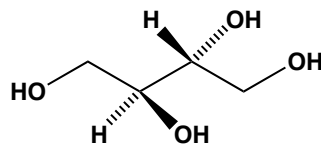


*both are S*

9. (8 points) The sugar alcohols *threitol* and *erythritol* have the general structure shown below. Threitol is chiral, but erythritol is not. Using the template given, produce a drawing of the structure of erythritol.

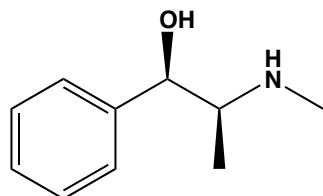


(general structure)



(template)

10. (8 points) Ephedrin is a naturally occurring compound with significant biological activity. It has a specific rotation of roughly -36 degrees.

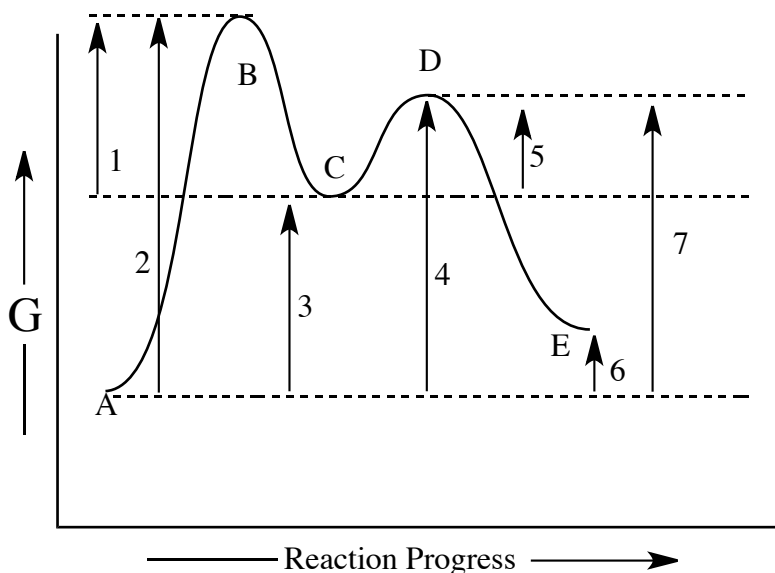


$$[\alpha]_D = -36 \text{ degrees.}$$

If a synthetic sample of ephedrin has an optical rotation of -9 degrees, what is the enantiomeric excess (ee) of that sample?

$$9/36 = 25\% \text{ ee}$$

11. (12 points) A reaction energy profile diagram is given below, and several key features are labeled, including energy differences (1-7) and different chemical species (A-E).

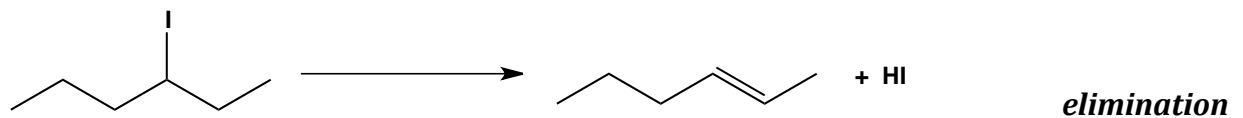


Provide the most appropriate feature (1-7, or A-E) from the diagram above to answer the following questions. Note: you can use one feature in more than one of the situations below.

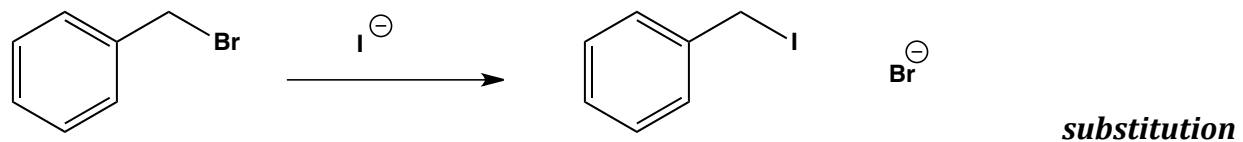
- For the reaction A→E, the rate-determining step is the reaction of A to C.
- For the reaction A→E, the equilibrium constant is determined by energy 6.
- For the reaction A→C, the activation energy is 2.
- The transition states for the two steps in the reaction A→E are points B and D.

12. (6 points) Classify each reaction below as either *substitution*, *addition*, or *elimination*

a)



b)



c)

