PRINT your name legibly on the line below.

__________________________________________

PRINT your student id number on the line below.

__________________________________________
**First**: You are allowed to have a writing utensil, a calculator and molecular model set at your seat. Please put away all other materials.

**Second**: Place your student identification on your desk. A proctor will come around to check your ID. **Put your name and number on your test?**

**Third**: Quickly 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 easy questions to do first.

**Fourth**: Write your answers in a clear, unambiguous manner. **SHOW YOUR WORK!**

**Fifth**: **READ THE INSTRUCTIONS FOR EACH PROBLEM. Answer each question**

<table>
<thead>
<tr>
<th>Problem Number</th>
<th>Points possible</th>
<th>Score</th>
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**Total** 100  ____
1. (5 pts.)  

1a Fill in the blank below. The name of compound 1a is:

(5 ___ )-1,5-dimethylcyclohexene

b. (5 pts.) Name compound 1b. Stereochemistry!

2. Think about the rate of formation of the following products.

a. (10 pts.) HCl adds across the double bond of optically pure 1a. However some of the products form so slow compared to others that we will have a hard time finding them in the product mixture which ones are they?____________________________
b. (10 pts.) Will any of the molecules above have identical rates of formation starting from 1a? Explain your answer. Hint: Tell me how the molecules are structurally related and tell me what this has to do with your answer. Short answer!

3. (15 pts.) Draw the products of addition of HCl. Identify which molecules, if any, will be present in equal amounts after the reaction is finished by drawing circles around the molecules and connecting the circles with lines.
4. (10 pts.) I assigned the reading of a brief paragraph entitled “S-ibuprofen versus ibuprofen-racemate. A randomized double-blind study in patients with rheumatoid arthritis.” Why should there be a difference in physical response between S-ibuprofen and ibuprofen-racemate?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

5. (10 pts.) Reaction A happens, but reaction B does not. Please explain why. Short answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

\[ \text{KOH} + \text{(structure)} \rightarrow H_2O + \text{(structure)} \]

\[ \text{KOH} + \text{(structure)} \rightarrow H_2O + \text{(structure)} \]
6. (10 pts.) Circle the pair of water molecules in the lowest-energy state.

molecules for question 6.

7. (10 pts.) Identify (name / describe) the HOMO and the LUMO in the reactants of the following SN2 reaction.

HOMO: __________________________________________________________________

LUMO: __________________________________________________________________
8. (15 pts.) Use the chair structure drawn below as a starting point to draw the lowest-energy conformation of molecule 2a (given above in problem 2). Put substituents on the structure; put methyl groups as CH₃ and put all H atoms on the structure. 10 pts. awarded for the correct conformation and 5 pts. for the correct enantiomer. Hint: Cl is small compared to CH₃.