

Last Name Answer

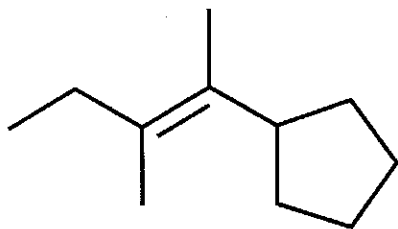
First Name Key

General Instructions:

- (i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.
- (ii) Print your name on each page.
- (iii) Please keep your paper covered and your eyes on your own work. Misconduct will lead to failure in the course.

1. (9 points) For each alkene below, circle the proper stereoisomer designation.

(a)



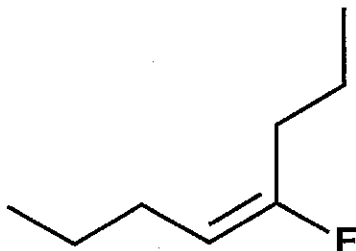
E

Z

Neither

+3

(b)



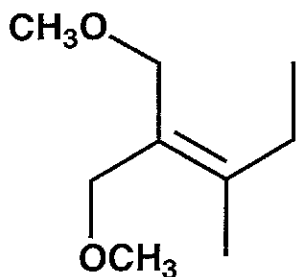
E

Z

Neither

+3

(c)



E

Z

Neither

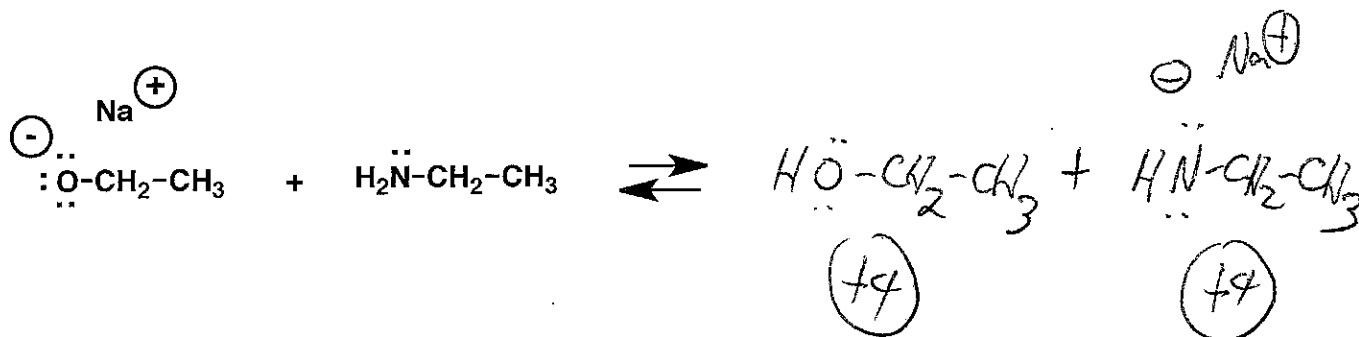
+3



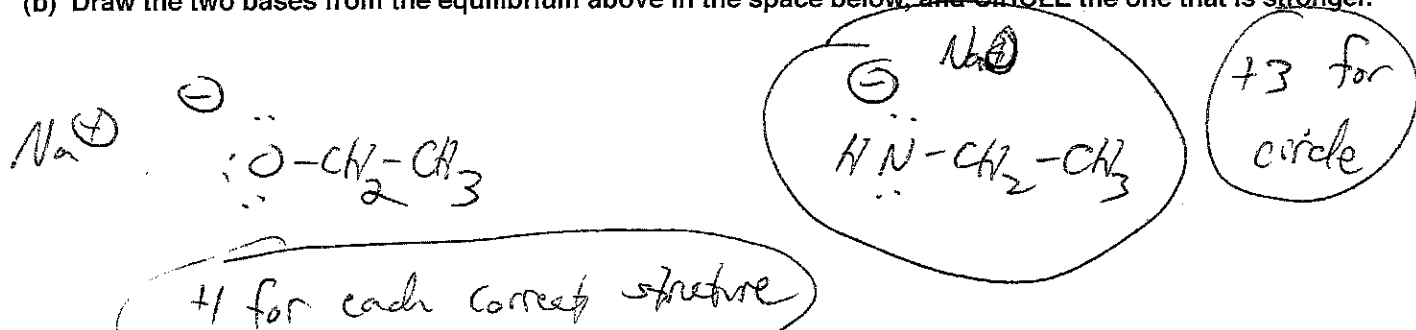
Name \_\_\_\_\_

3. (20 points)

(a) Draw in the other side of the Brønsted acid-base equilibrium involving the two species shown below.



(b) Draw the two bases from the equilibrium above in the space below, and CIRCLE the one that is stronger.

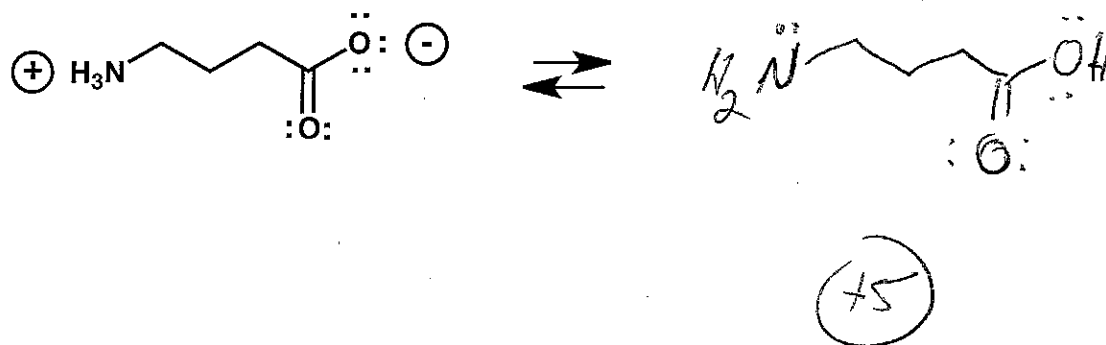


(c) Which side of the the equation in part (a) is favored (circle the correct word below)?

LEFT
RIGHT

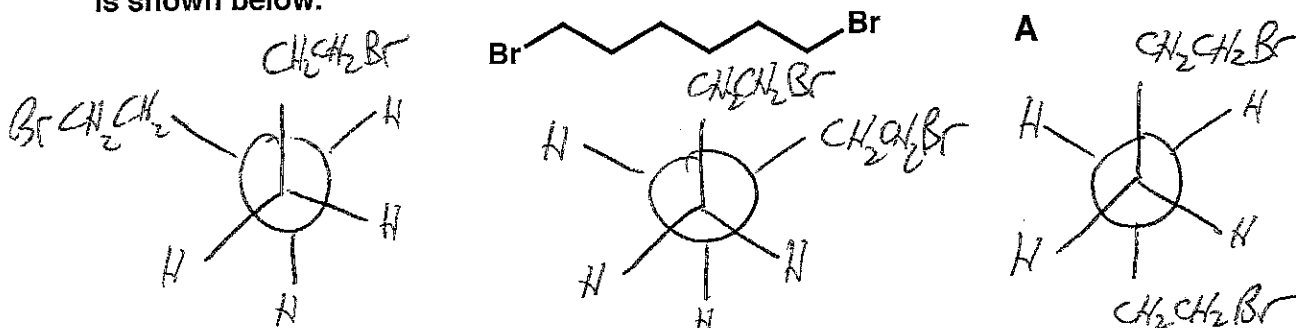
+2

(d) Draw in the other side of the Brønsted acid-base equilibrium involving the single species below.

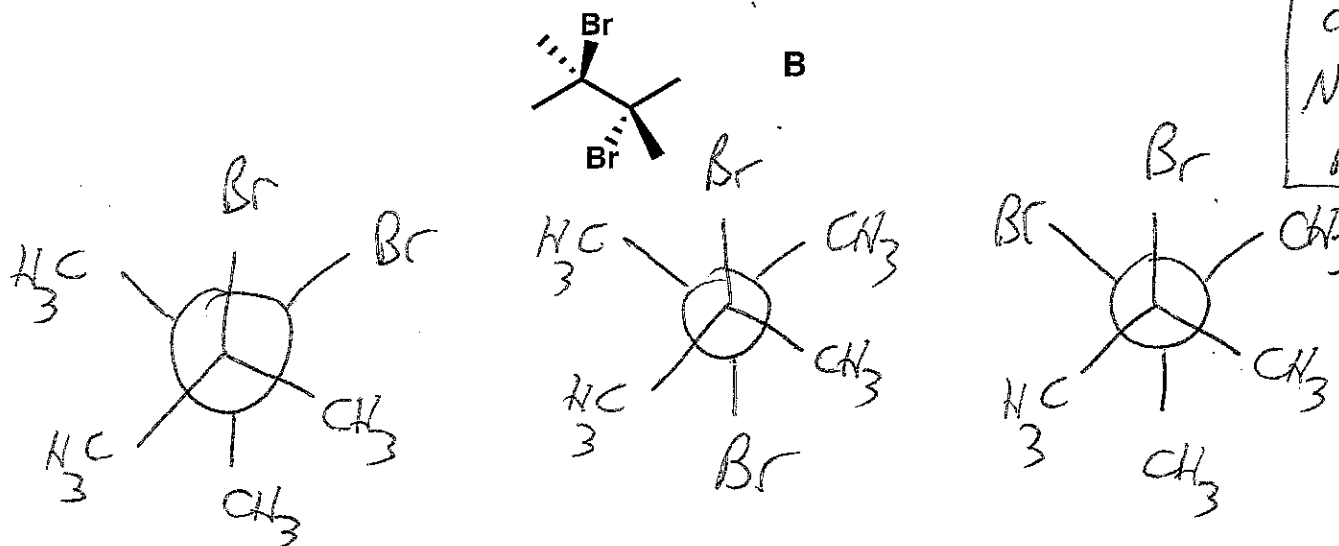


## 4. (22 points)

(a) Draw all three staggered Newman projections about the central bond of molecule A, which is shown below.



(b) Draw all three staggered Newman projections about the central bond of molecule B, which is shown below.



(c) The heats of formation for isomers A and B are negative, but the value for A is slightly more negative than the value for B (i.e., the absolute value of the heat of formation of A is larger than the absolute value of the heat of formation of B).

A bromine atom is nearly the same size as a methyl group.

Based on this information and the answers to parts (a) and (b), explain in one sentence why the heat of formation is more negative for A than for B.

A is more stable than B, because A can adopt a conformation that has no gauche interactions (steric repulsions involving C and/or Br) while such gauche interactions cannot be avoided in B.

(+4)

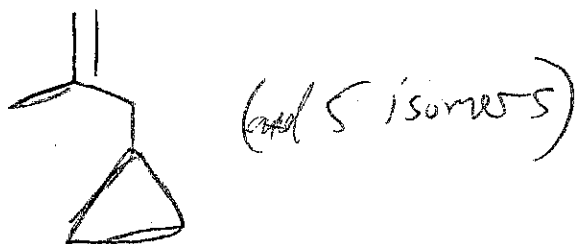
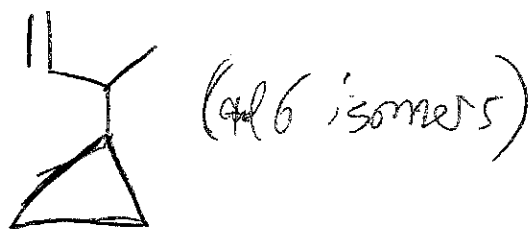
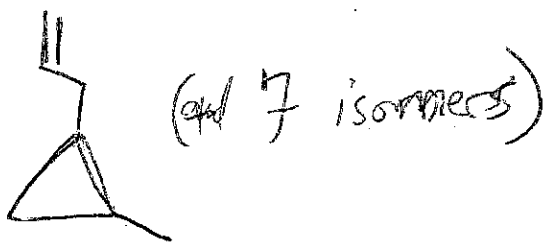
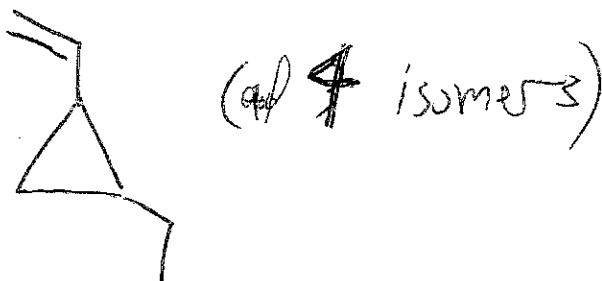
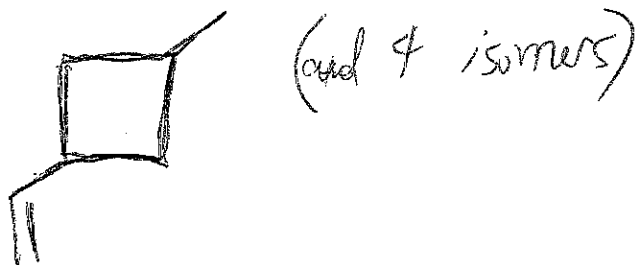
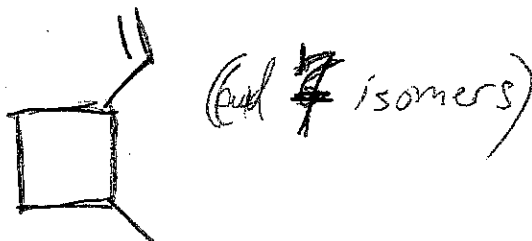
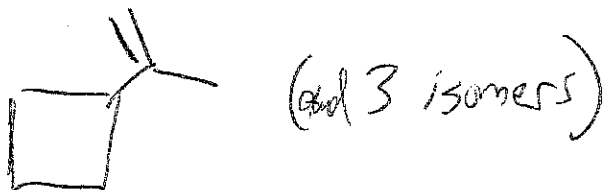
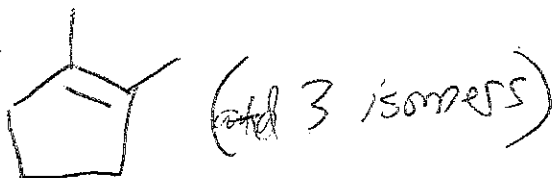


6. (25 points)

Molecule X has the formula  $C_7H_{12}$  and reacts with one molar equivalent of  $H_2$  in the presence of Pd/C; no further reaction occurs if additional  $H_2$  is present. The product is an alkane that contains two (and only two)  $3^\circ$  carbon atoms.

Propose FIVE possible structures for molecule X.

Many possibilities, including:



15 for each correct answer