

Organic Chemistry 1 – CHM 2210

Exam 2 (October 10, 2001)

Name (print): _____

Signature: _____

Student ID Number: _____

There are 10 multiple choice problems (4 points each) on this exam. Record the answers to the multiple choice questions on THIS PAGE. There are also 9 short answer questions (#19 is a bonus problem). Please take care in drawing the chemical structures for these short answers. You will be graded out of 100 points.

1 _____

6 _____

2 _____

7 _____

3 _____

8 _____

4 _____

9 _____

5 _____

10 _____

Multiple choice total
40

Short answer total
60

Overall
100

1. A gasoline that has the same combustion characteristics as a mixture of 13% 2,2,4-trimethylpentane and 87% heptane would be rated as...

- a) 87-octane gasoline.
- b) 13-octane gasoline.
- c) 74-octane gasoline.
- d) not possible to determine from the information given.

2. Complete the following statement: unbranched alkanes contain...

- a) only primary carbon atoms
- b) only primary and secondary carbon atoms
- c) only secondary carbon atoms
- d) 1°, 2°, and 3° carbons atoms as long as they are drawn in a zigzag fashion
- e) None of the above

3. Consider three isomeric alkanes: 2,3-dimethylpentane, n-heptane, and 2-methylhexane. Which of the following correctly lists these compounds in order of INCREASING boiling point?

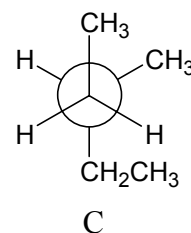
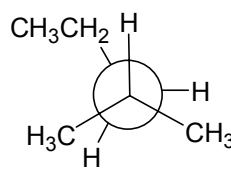
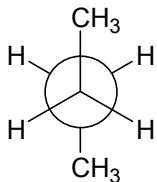
- a) n-heptane < 2-methylhexane < 2,3-dimethylpentane
- b) 2-methylhexane < n-heptane < 2,3-dimethylpentane
- c) 2-methylhexane < 2,3-dimethylpentane < n-heptane
- d) 2,3-dimethylpentane < 2-methylhexane < n-heptane
- e) cannot determine from the information given

4. Which of the following is not a bridged cycloalkane?

- a) *cis*-decalin
- b) bicyclo[2.2.1]heptane
- c) bicyclo[3.2.1]octane
- d) bicyclo[4.1.1]octane
- e) none of the above

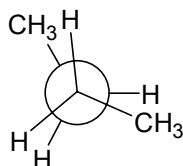
5. The correct Newman projection formula for the C2-C3 bond of 2-methylpentane would be...

- a) A
- b) B
- c) C
- d) Both A and C
- e) None of the above.

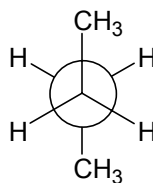


6. Rank the following conformations of butane from highest to lowest potential energy.

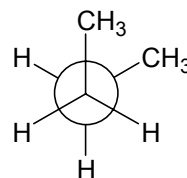
- a) $A > B > C$
- b) $B > C > A$
- c) $C > A > B$
- d) cannot determine from the information given



A



B



C

7. The internal angles of a pentagon are 108° - therefore the conformation of cyclopentane is...

- a) planar since the bond angles would be very close to the ideal 109.5° .
- b) slightly bent to avoid torsional strain
- c) more stable than cyclohexane
- d) none of the above

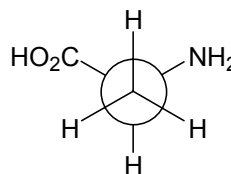
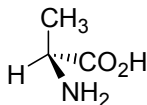
8. Is the molecule shown below chiral or achiral?

- a) Chiral
- b) Achiral



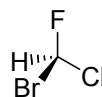
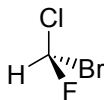
9. Which of the following terms best describes the relationship between the pair of compounds shown below?

- a) Enantiomers
- b) Diastereomers
- c) The same compound



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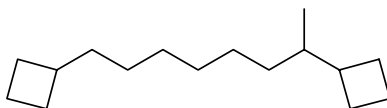


11. The heat of combustion for cyclopropane is 2091 kJ/mol and for cyclopentane 3320 kJ/mol. *Briefly* explain how can this data be reconciled with the fact that cyclopentane has far less ring strain than cyclopropane (6 pts).

12. Draw a *Newman projection* for the chair form of cyclohexane (6 pts).

13. Draw the most stable chair conformation of *trans*-1-*tert*-butyl-3-methylcyclohexane. Clearly depict all axial and equatorial hydrogen atoms and substituents (6 pts).

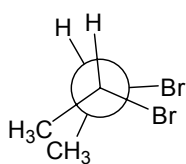
14. Using starting materials containing no more than 7 carbon atoms, show how you would synthesize the following compound (a retrosynthetic analysis is not required). Show all necessary reagents (12 pts).



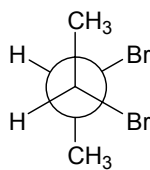
name? (see problem 15)

15. Name the final product in problem 14 above (4 pts).

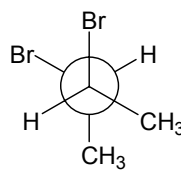
16. Shown below are the Newman projection formulas for (R,R)-, (S,S)-, and (R,S)-2,3-dibromobutane. Which is which? (6 pts).



A

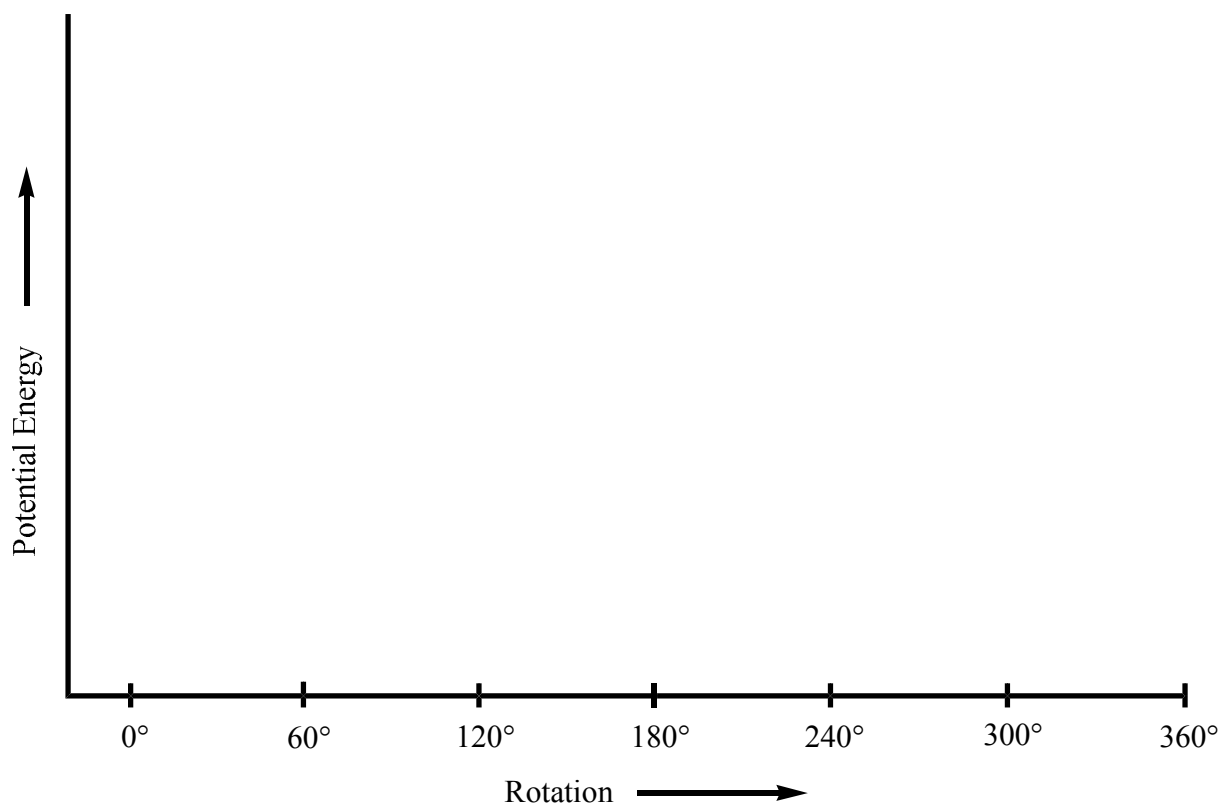


B

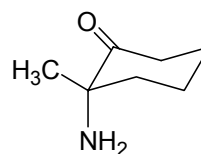
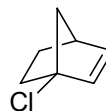
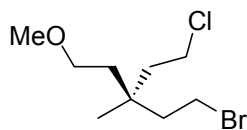
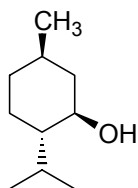
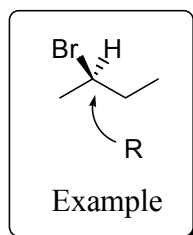


C

17. On the axes given below, sketch a curve showing the energy changes that arise from rotation about the C2-C3 bond of 2,2-dimethylbutane. Clearly label all maxima and minima with the appropriate conformations using Newman projection formulas. The actual numerical values of the energy changes are not required (13 pts).



18. Label each chiral carbon atom in the compounds shown below as R or S. Use an arrow to clearly indicate the carbon being labeled (see example) (7 pts).



19. *Bonus problem* - draw the *exact* structure (including stereochemistry) for *either* cholesterol or androsterone (4 pts).