

Instructions: This is a 50 minute, closed book examination. You may not use any notes, books, or external materials during the course of the examination. PRINT CLEARLY your name and social security number on the front page of the examination in the indicated space below. Also please PRINT YOUR NAME ON TOP OF EACH PAGE OF THE EXAM.

Be sure to allot your time in a manner that is related to the point value of the question. All material to be graded should be written on the exam sheet in the space provided or on the back page of the exam sheet. Please show your thinking and if you wish indicate any assumptions or rules you are following to produce an answer. Any relevant ideas will receive credit even if the answer is incomplete.

YOUR NAME : _____

YOUR SOC. SEC. NUMBER : _____

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|-------------|------------|-------|
| Question 1: | 10 Points | _____ |
| Question 2: | 20 Points | _____ |
| Question 3: | 10 Points | _____ |
| Question 4: | 20 Points | _____ |
| Question 5: | 20 Points | _____ |
| Question 6: | 20 Points | _____ |
| TOTAL | 100 Points | |

1. (10 Points). Lewis and resonance structures.

Consider the composition $(\text{CO}_3)^{2-}$

(a) Draw clearly a Lewis structure with carbon as the central atom which represents a constitution for this composition and obeys the octet rule on all of the atoms. Indicate clearly the formal charge on each atom.

(b) Draw clearly every equally stable resonance form that is distinct with respect to electron distribution to the one that you have drawn above in (a).

(c) Draw clearly a description of a resonance hybrid for $(\text{CO}_3)^{2-}$.

2. (20 Points). Constitutional isomers (Chapter 1, 1.34).

Write Lewis structures for all of the constitutional isomers of the composition C_3H_6O that contain

(a) Only single bonds

(b) At least one double bond

3. (10 Points). Alkanes. Boiling points

Consider the composition C_5H_{12} .

- (a) Write the Lewis structure for all of the possible constitutional isomers of this composition.
- (b) Predict which of the isomers will have the highest boiling point.
- (c) Predict which of the isomers will have the lowest boiling point.
- (d) Briefly explain the reasoning behind your prediction.

4. (20 Points) Conformational Analysis.

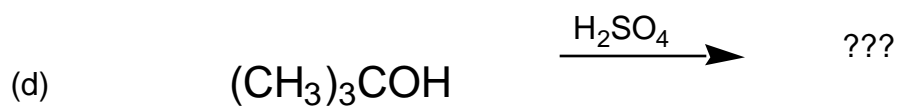
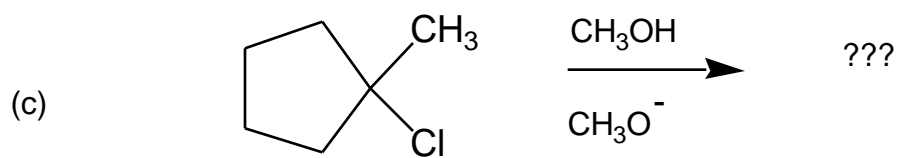
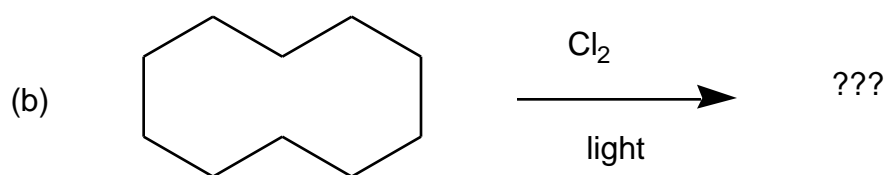
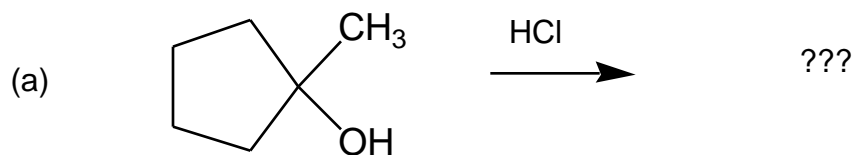
(a) Draw clearly the most stable conformation of 1-methyl-1-tert-butyl cyclohexane.

(b) Draw the most stable conformation of 1-methyl-4-tert-butyl cyclohexane.

(c) Draw the most stable conformation of the 1,2,4 trimethyl cyclohexane for which all of the methyl groups are cis to one another.

5. 20 Points. Synthesis

Write the Lewis structure of the major product you expect to be produced from the following reactions.



6. 20 Points. Structure determination.

Consider all of the Lewis structures of composition $(\text{CH})_6$, ie., all isomers which have only CH bonds. Benzene's accepted structure was deduced from this set of structures by a method similar to that used to deduce the structure of methane.

(a) Draw the Lewis structures of all of the $(\text{CH})_6$ isomers.

(b) Suggest a method to deduce the correct structure of benzene which is known to have the composition $(\text{CH})_6$.