

CHEMISTRY 261 - Section A3

MIDTERM

Dr. John C. Vederas

140 Points - 50 Minutes

Part	Points		KEEP THIS QUESTION BOOKLET
I	60		
II	40		Do NOT Turn In This Booklet
III	10		
IV	30		PUT ANSWERS ON COLOUR ANSWER SHEET
Total	140		ANSWER SHEET INTO BOX AT FRONT OF ROOM

Before you begin be sure that your exam has **9** consecutively numbered pages including this cover sheet. **Do not begin until told to do so.** When you begin, please **print** your name **on the colour answer sheet** in the correct slot. Illegible answers will be marked as incorrect. No books, notes, or unauthorized communications are permitted. If you have any questions or problems, please raise your hand. Do not leave your seat without permission. **Models are permitted but may not be handed to another** and **NO** calculators, phones or other electronic devices are to be used. Turn in only the coloured answer sheet when you are finished.

GOOD LUCK

You will keep this question booklet – Place all answers on coloured Answer Sheet in correct slot

I. Structure and Nomenclature - 60 Points

A. Draw structures for which names are given, or name the given structures by any correct (systematic or common) nomenclature. Be sure to give cis or trans (Z or E), or if appropriate R or S, assignment to the isomer where indicated by asterisks (***). **(4 points each – 24 points total)**

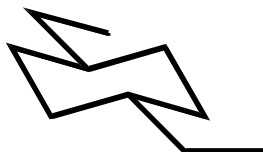
1. chloroform

This is NOT your answer sheet : the space here is for preliminary work / scratch paper only

2. isopropyl chloride

*** 3. trans-1-butyl-3-cyclopropylcyclopentane

*** 4.



Place all answers on coloured Answer Sheet

*** 5.



This is NOT your answer sheet : the space here is for preliminary work / scratch paper only

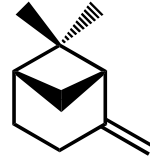
*** 6. (Z)-3-bromo-1,2-dichloro-2-pentene

Place all answers on coloured Answer Sheet

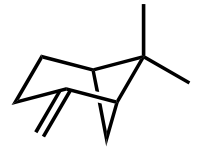
B.

Determine whether the following pairs of structures are identical, structural isomers, diastereomers or enantiomers . (4 points each – 16 points total)

7.

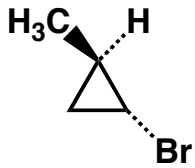


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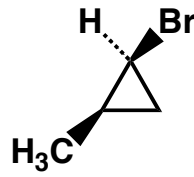


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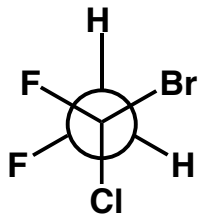
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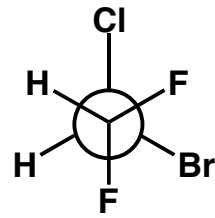
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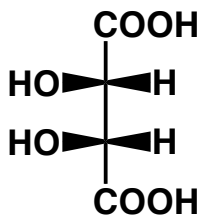
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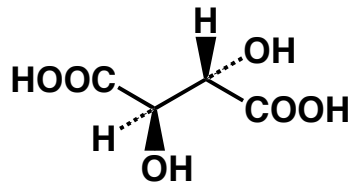
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10.



and

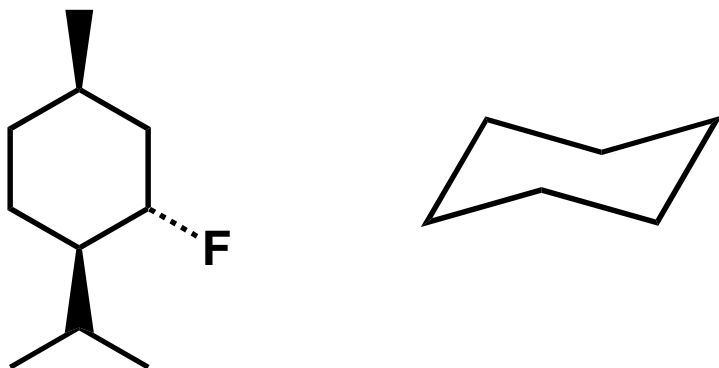


Place all answers on coloured Answer Sheet

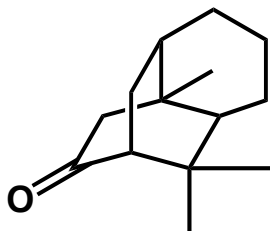
C. Conformation – 20 pts
Place all answers on coloured Answer Sheet

11. Draw the most stable conformation of the molecule shown below. Use the template provided for your drawing. If you make an error in ink, please redraw the template in correct slot on the answer sheet.

(5 pts)


Place all answers on coloured Answer Sheet

The compound shown below is a perfume constituent. Examine its structure and answer the questions that follow.



3 pts each – 15 pts total

12. On the answer sheet, circle all the stereogenic centres in the structure (no partial credit)
13. The number of stereogenic centres in the above compound is _____
14. The number of degrees of unsaturation in the above compound is _____
15. The name of the oxygen-containing functional group in the compound is _____
16. The number of carbons in the compound is _____

Place all answers on coloured Answer Sheet
Place all answers on coloured Answer Sheet

II. Definitions and Concepts - 40 points

A. Indicate whether the following statements are true (T) or false (F) by putting the correct letter on your answer sheet. No penalty for guessing. (2 points each - total 20 points)

- | | | |
|--|---|---|
| 1. Steric effect is mutual repulsion of atoms having inert gas configuration of electrons | T | F |
| 2. A Lewis acid is a nucleophile | T | F |
| 3. Changing all of the chiral centers (e.g. R to S) in a chiral molecule will give an enantiomer | T | F |
| 4. A meso compound is achiral | T | F |
| 5. A 80:20 mixture of enantiomers has an optical purity of 60 % | T | F |
| 6. A 80:20 mixture of enantiomers has an enantiomeric excess of 60 % | T | F |
| 7. A chiral reagent or method is always required to separate enantiomers | T | F |
| 8. The S _N 2 reaction has a carbocation intermediate | T | F |
| 9. The density of substances which float on water is usually less than 1.0 | T | F |
| 10. Intermolecular attraction of alkane molecules is due to London forces | T | F |

Place all answers on coloured Answer Sheet

Place all answers on coloured Answer Sheet

B. Choose the appropriate letter to indicate whether each of the following statements is true (T) or false (F). No penalty for guessing. (Similar to previous exams but be cautious) (2 points each - total 20 points)

- | | | |
|--|---|---|
| 11. ΔG is negative for an endothermic reaction | T | F |
| 12. Resonance forms are not rapidly interconverting molecules | T | F |
| 13. About 150 to 200 kcal/mole of energy are available at room temperature | T | F |
| 14. The net dipole of dichloromethane is aligned with a carbon-chlorine bond | T | F |
| 15. A completely pure organic compound may have different physical properties depending on whether it was made by chemists or isolated from Nature | T | F |
| 16. Bronsted-Lowry acids donate a proton | T | F |
| 17. A carbocation intermediate in a reaction is a transition state | T | F |
| 18. The pK_a of pure water is about 7 | T | F |
| 19. The structure of a molecule determines all of its physical and biological properties | T | F |
| 20. Overlap of two sp^2 orbitals in a double bond generates a sigma molecular orbital | T | F |

Place all answers on coloured Answer Sheet

Place all answers on coloured Answer Sheet

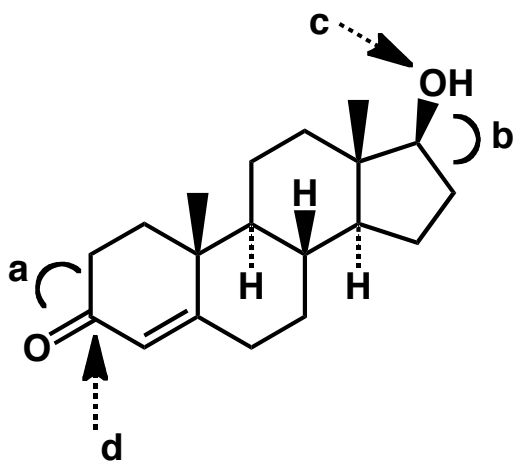
III. Atomic Structure and Molecular Structure - 10 Points

Place all answers on coloured Answer Sheet

A. Methyl nitrate is a rocket fuel that explodes spontaneously at 65 °C. Its molecular formula (and linear structure) is CH_3ONO_2 .

1. Draw the structure in full to show all bonds, lone pairs and formal charges that are not zero. (2 points)

B. Testosterone is steroid hormone that maintains male sexual characteristics (an androgen). It is produced in both males and females, but in adult males the levels of production are about 20 times greater. Examine its structure and answer the questions.



2. What is the angle labeled **a** ? (2 pts)

3. What is the angle labeled **b** ? (2 pts)

4. What is the functional group labeled **c** ? (2 pts)

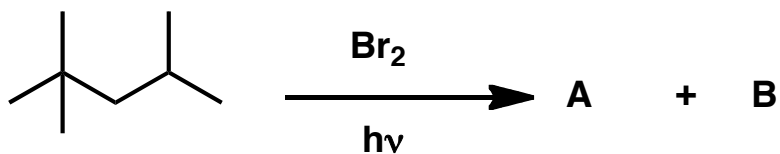
5. What is the hybridization of the atom labelled **d** ? (2 pts)

Place all answers on coloured Answer Sheet

Place all answers on coloured Answer Sheet

IV. Reactions and Mechanism - (30 points)

A. Examine the overall reaction shown below and answer the questions that follow.



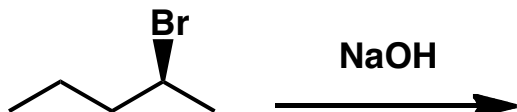
1. Assuming there is one equivalent of Br_2 for each equivalent of alkane, show the structures of the two major products A and B. (5 points)

2. Write both propagation steps for the reaction. (10 pts)

3. Write one termination step for this reaction (5 pts)

4. If one uses one equivalent of F_2 instead of Br_2 to halogenate the same alkane, show the structure of the major monofluorinated product. (5 pts)

5. Show the major substitution product of the reaction below (5 pts)



Place all answers on coloured Answer Sheet