

CHEMISTRY 261 - Section A3**Final Exam - December 16, 2014 - Dr. John C. Vederas****200 Points - 3 Hours**

Part	Points		PRINT LAST NAME:
I	75		TURN IN THIS BOOKLET WITH ANSWER SHEET
II	32		
III	70		
IV	23		PUT ALL ANSWERS ON COLOUR ANSWER SHEET
Total	200		

Before you begin be sure that your exam has **13** consecutively numbered pages including this cover sheet. **Do not begin until told to do so.** When you begin, please **print** your name **on each page** of this exam question sheet in the upper right hand corner. **Also** 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 BOTH the exam booklet and the coloured answer sheet when you are finished.** Please place your **ID Card** on your desk.

Good Luck ! - Have an Enjoyable Holiday !

I. Structure and Nomenclature - 75 Points

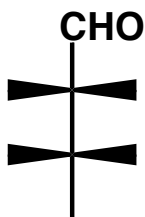
A. Draw structures for which names are given, or name the given structures by any correct (systematic or common) nomenclature. Be sure to give cis or trans (or if appropriate Z or E) or R or S assignment to the isomer where indicated by asterisks (***). **(4 points each - 40 points total)**

This is NOT your answer sheet : the space here is for preliminary work / scratch paper only- not graded
However, you will need to turn in this question sheet to receive credit for your answers

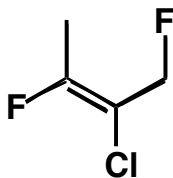
1. ethylene glycol

2. polystyrene (use bracket notation)

*** 3. D-Glucose - open chain form - (use part structure in your drawing to assist grading)



*** 4. (specify E or Z)



*** 5. (a C₂₀ compound)

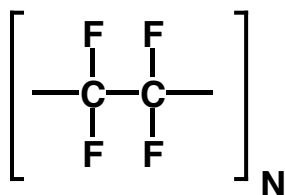
*** 6.

Place all answers on coloured Answer Sheet

NAME _____

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7.



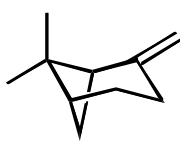
8. 1,11-tridecadiene-3,5,7,9-tetrayne (a compound responsible for flower colour in dahlias)

*** 9. trans-(R)-5-methoxy-1,3-heptadiene

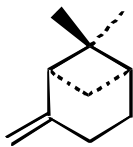
10. phenol

B. Determine whether the following pairs of structures are identical (i.e. different pictures of the same molecule), structural isomers, diastereomers, or enantiomers. **(4 pts each - 20 pts total)**

11.

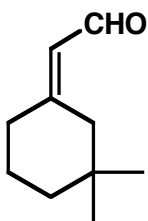


and

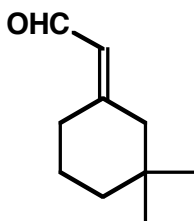


α -pinene (major constituent of turpentine)

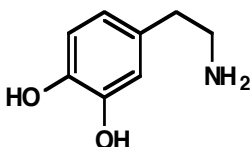
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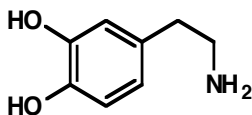
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13.

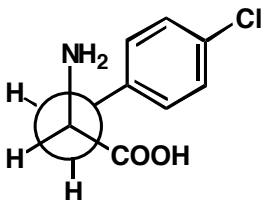


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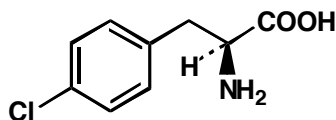


Dopamine (a neurotransmitter involved in Parkinson's disease)

14.

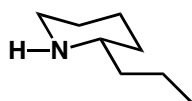


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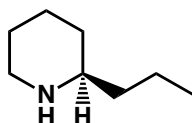


p-chlorophenylalanine - an aphrodisiac

15.



and

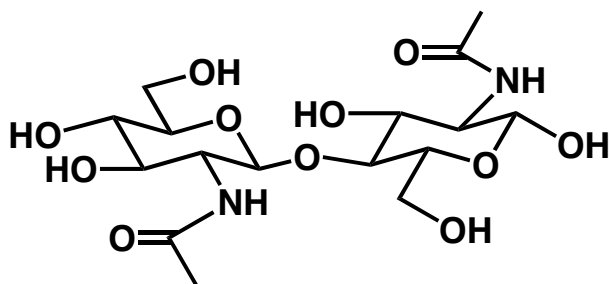


Coniine (hemlock poison which killed Socrates)

Place all answers on coloured Answer Sheet

NAME _____

C. Chitobiose is a carbohydrate derived by cleavage of the chitin outer shell of crustaceans (e.g. crabs) and insects. Examine its structure below and answer the questions that follow. **(15 points total)**



Place all answers on coloured Answer Sheet

16. The number of carbons in chitobiose is

_____ 2 pts

17. The number of hydrogens in chitobiose

_____ 3 pts

Answer the following questions as true (T) or false (F) No penalty for guessing.

(1 point each - 10 points total)

Place all answers on coloured Answer Sheet

18. chitobiose is more acidic than water.

T F

19. chitobiose is a non-reducing sugar

T F

20. chitobiose has two anomeric carbons

T F

21. chitobiose could be made by coupling two identical monosaccharides

T F

22. chitobiose is easily isomerized in water by a rapid equilibrium

T F

23. chitobiose contains only D-sugar units

T F

24. chitobiose contains two amino functionalities

T F

25. chitobiose contains 10 stereogenic centres

T F

26. the chitobiose structure above has only β linkages at the anomeric carbons

T F

27. chitobiose contains six primary alcohols

T F

II. Concepts and Definitions – 32 points

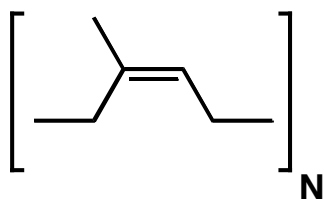
A. Indicate whether the following statements are true (T) or false (F) by putting a circle around the correct letter. No penalty for guessing. (1 point each - 16 points total)

- | | | |
|---|----------|----------|
| 1. Steric effect is mutual repulsion of atoms having inert gas configuration of electrons | T | F |
| 2. A Lewis acid is an nucleophile | T | F |
| 3. A Lewis acid accepts a pair of electrons | T | F |
| 4. Resonance forms are structures of rapidly interconverting molecules | T | F |
| 5. Changing all of the chiral centers (e.g. R to S) in a chiral molecule will give an enantiomer | T | F |
| 6. A 80:20 mixture of enantiomers has an optical purity of 60 % | T | F |
| 7. A 80:20 mixture of enantiomers has an enantiomeric excess of 60 % | T | F |
| 8. A chiral reagent or method is always required to separate enantiomers | T | F |
| 9. Cis-1,2-dichlorocyclopropane and trans-1,2-dichlorocyclopropane are diastereomers | T | F |
| 10. Tautomers are structural isomers with respect to each other | T | F |
| 11. The atomic number of an atom is the total number of protons and neutrons in the nucleus | T | F |
| 12. The E1 reaction has a carbocation intermediate | T | F |
| 13. The Zaitsev (Saytzeff) rule favours formation of more highly substituted double bonds | T | F |
| 14. Oxidation is always defined as the process of adding oxygen atoms | T | F |
| 15. The density of substances which float on water is usually less than 1.0 | T | F |
| 16. A completely pure organic compound may have different physical properties depending whether it was made by chemists or isolated from Nature | T | F |

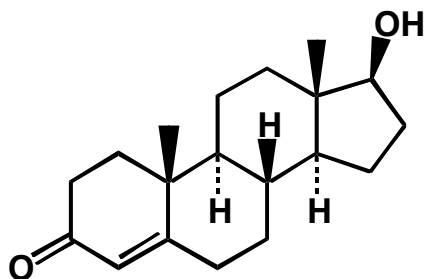
B. 17. Draw the most stable conformation of cis-4-bromocyclohexanol (either enantiomer) (7 pts)

C. The compounds shown below were discussed in class. Identify them by common name and briefly (5 words or less) describe their importance or use. (9 points – 3 pts each)

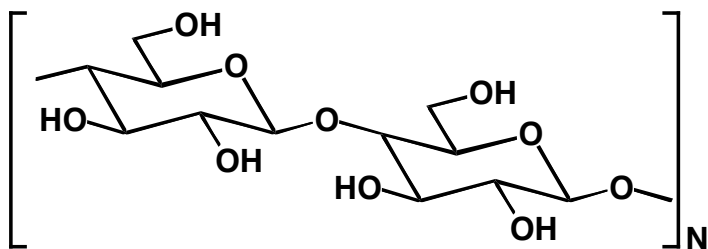
18.



19.



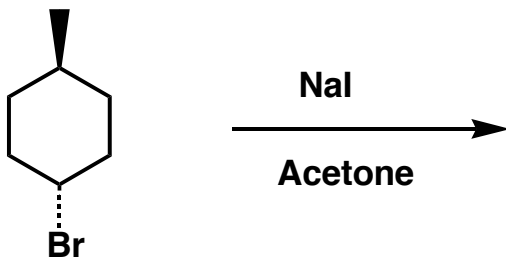
20.



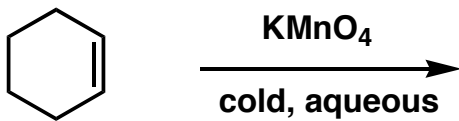
III. Reactions - 70 Points

A. Show the structure of the major organic product of each of the following reactions. Show stereochemistry where indicated by asterisks (***) . (4 points each - 40 points total)

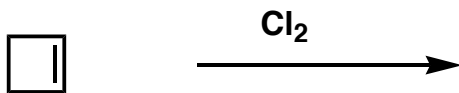
*** 1.



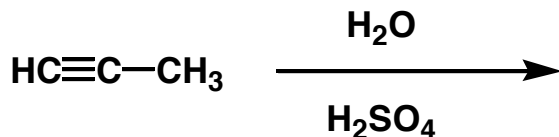
*** 2.



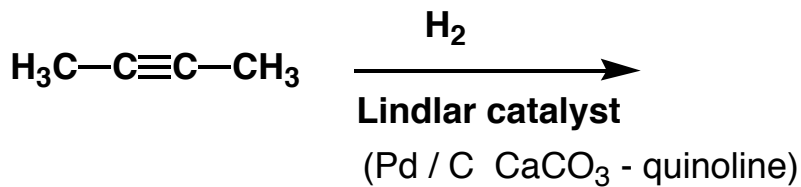
*** 3.



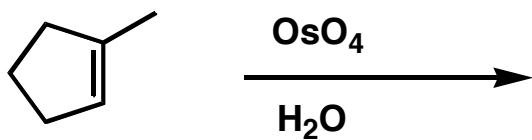
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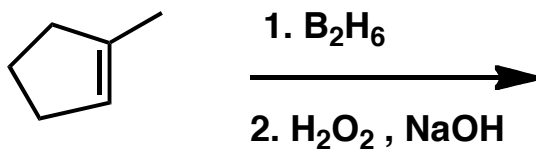
*** 5.



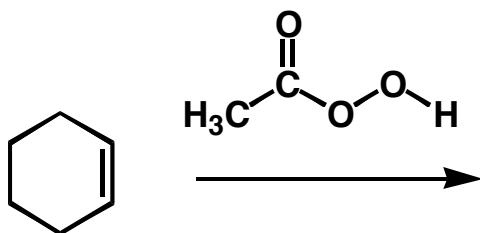
*** 6.



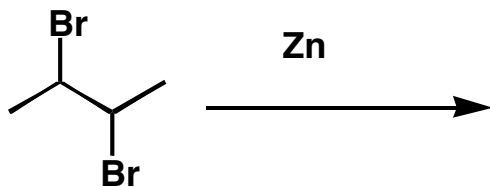
*** 7.



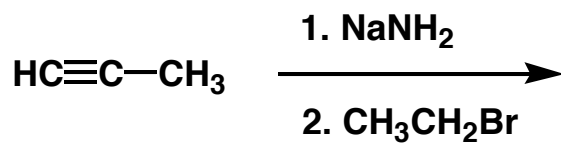
*** 8.



9.

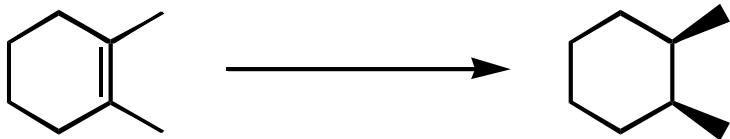


10.

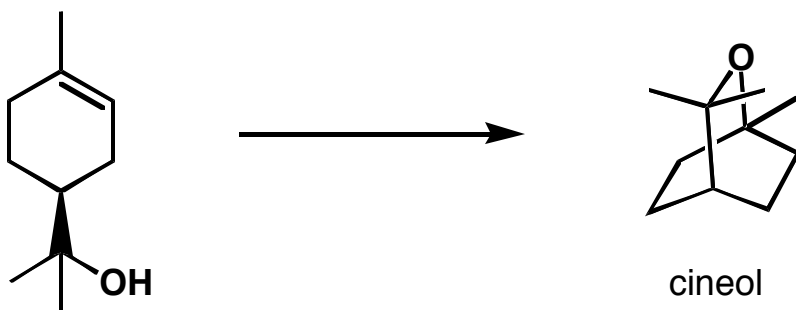


B. Show reagents that will do the required transformations. In some cases two steps may be necessary.
(4 pts each - 20 pts total)

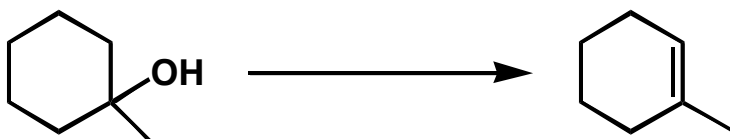
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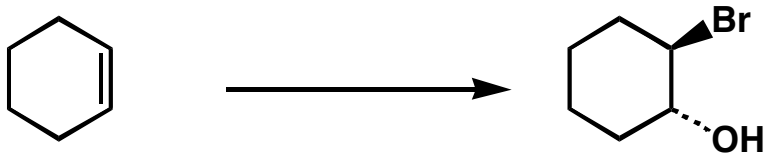
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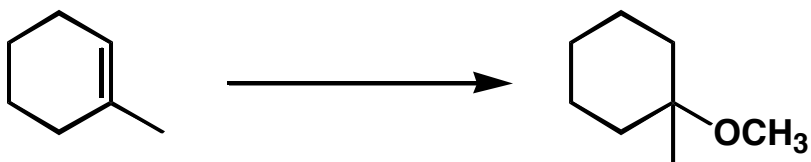
13.



14.



15.



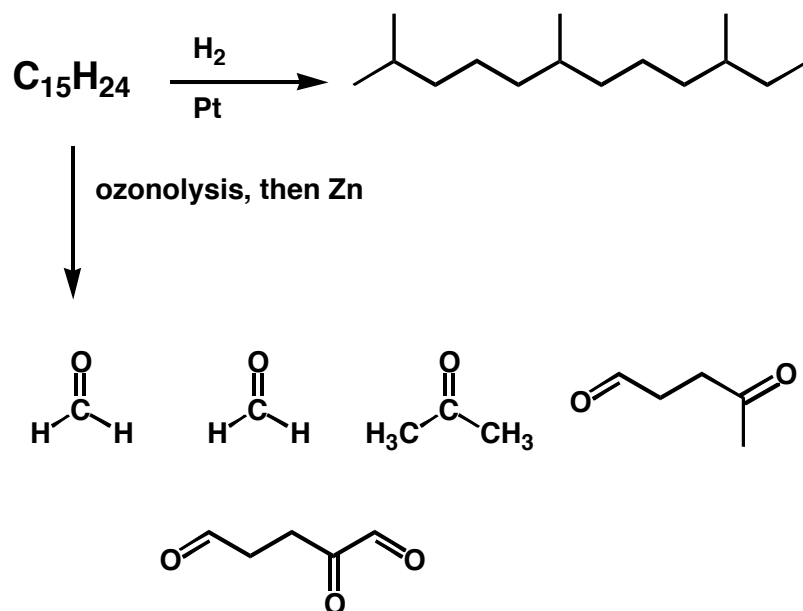
C. The green aphid produces an alarm pheromone which alerts other aphids to danger. The pheromone has a molecular formula of $C_{15}H_{24}$ and absorbs four moles of hydrogen upon catalytic hydrogenation in the presence of platinum catalyst. Ozonolysis of the pheromone followed by treatment with zinc dust gives the mixture of compounds indicated.

16. Give the structure of the alarm pheromone (ignore stereochemistry) (7 points) and then answer the following questions:

17. How many degrees of unsaturation does the pheromone have? (1 pt)

18. How many double bonds in the pheromone are conjugated? (1 pt)

19. How many of the double bonds are capable of having a stereoisomer? (1 pt)



IV. Mechanism - 23 Points

A. Provide detailed mechanisms for the reactions below using curved arrows to indicate the movement of electrons. Be sure to show correct charges on intermediates where necessary. **(10 Points Total)**

1. (5 points)



2. (5 points)



B. Examine the reactions shown below (13 points)

3. Which of the two isomers depicted below would you expect to undergo E2 elimination faster, A or B ? 1pt

4. Draw isomer A molecule in its most stable conformation 2 pt

5. Draw isomer B molecule in its most stable conformation 2 pt

6. Show the mechanism of the reaction to explain your answer. No credit will be given for this part unless you use the conformational drawing of the faster reacting isomer and attempt to show the mechanism. 8 pts

