

THE COLLEGE OF THE BAHAMAS

EXAMINATION

SEMESTER 01-2007

FACULTY OF PURE AND APPLIED SCIENCES

SCHOOL OF SCIENCES AND TECHNOLOGY

X NASSAU
FREEPORT
EXUMA
ELEUTHERA

DATE AND TIME OF EXAMINATION: Monday, April 23, 2007 at 7 pm
DURATION: 3 HOURS

COURSE NUMBER: CHEM 230

COURSE TITLE: ORGANIC CHEMISTRY

STUDENT NAME:

STUDENT NUMBER:

LECTURER'S NAME

INSTRUCTIONS TO CANDIDATES: This paper has 9 pages and 15 questions. Please follow instructions given.

THE COLLEGE OF THE BAHAMAS
FACULTY OF PURE AND APPLIED SCIENCES
SCHOOL OF SCIENCES AND TECHNOLOGY

NASSAU:

FREEPORT:

DEPARTMENT OF CHEMISTRY
FINAL EXAMINATION FOR SEMESTER 012007
COURSE NUMBER: 230
COURSE TITLE: ORGANIC CHEMISTRY

DATE AND TIME:

DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES: The exam paper consists of 9 pages and fifteen questions exclusive of this introductory page. All questions are to be answered in the spaces provided on this question paper.

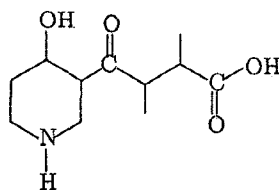
YOU MUST RETURN THE EXAMINATION PAPER AT THE END OF THE EXAMINATION.

STUDENT NAME:

STUDENT NUMBER:

LECTURER'S NAME:

1. Name four functional groups present in the compound



..... (4 marks)

2. (a) Draw Newmann projections illustrating the staggered and eclipsed conformers of ethane. (2 marks)

- (b) Explain why conformers of ethane in a staggered conformation are more stable than in an eclipsed conformation. (3 marks)

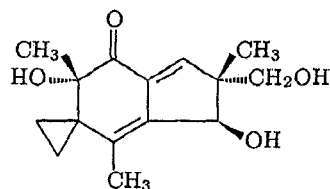
.....
.....
.....

3. Ethoxyethane and 1-butanol are equally soluble in water, but the boiling point of 1-butanol is 83°C higher than that of ethoxyethane. Fully explain *both* of these observations.

.....
.....
.....
.....
.....
.....
.....

(6 marks)

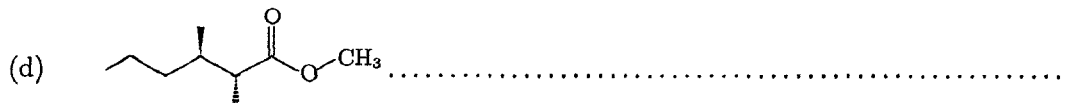
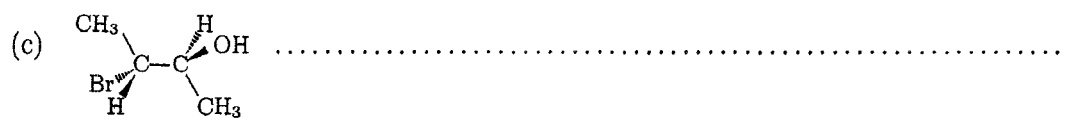
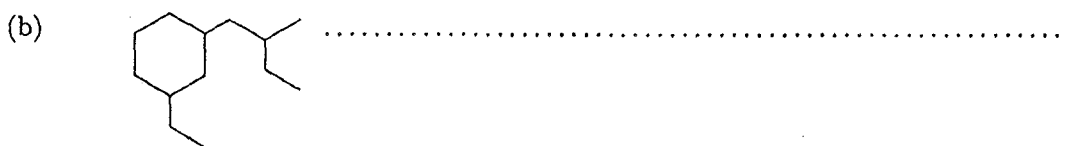
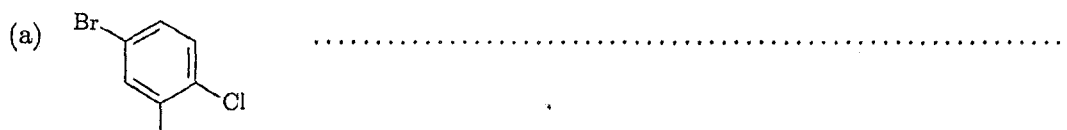
4. Illudin, an anti-tumor, antibiotic substance is shown below.



- (a) Identify and label with an asterisk all of the chirality centers in illudin. You will lose marks for each incorrectly labelled carbon.
 (b) How many stereoisomers of the molecule are possible?.....
 (c) How many sp^2 hybridized carbon atoms are in this molecule?.....

(5 marks)

5. Give systematic names including stereochemical designations (*R*, *S*, *cis*, *trans*) when required for the following molecules.



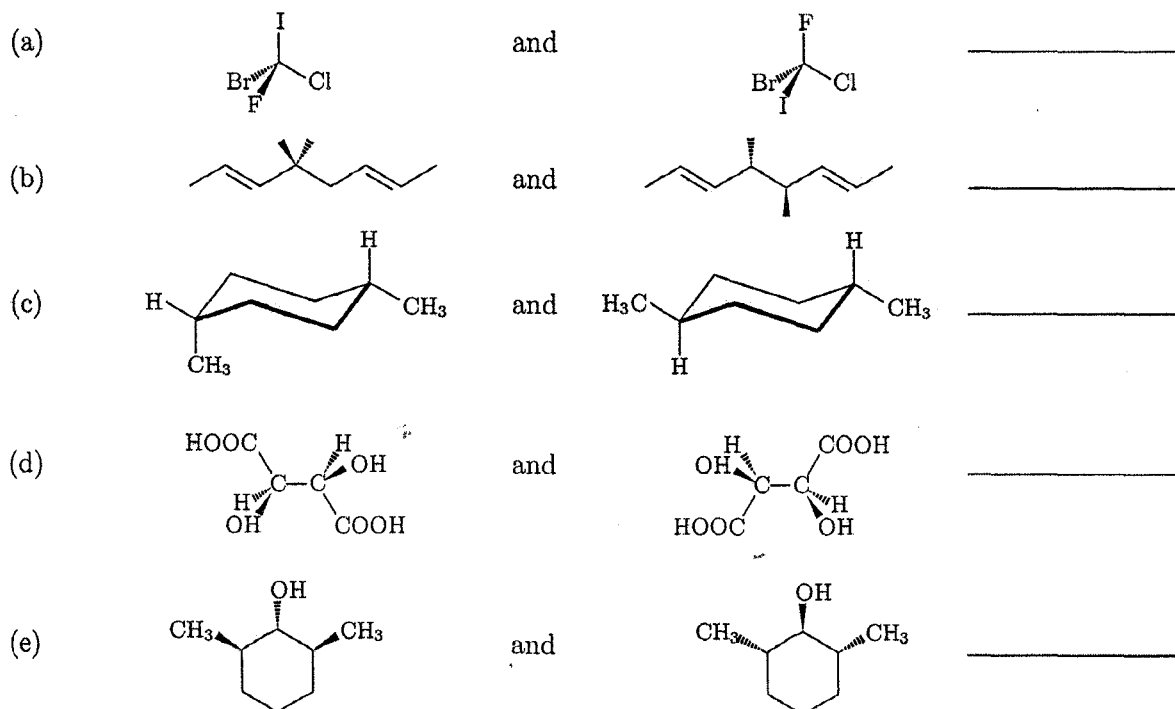
(6 marks)

6. On the basis of ring strain, cyclopropane, is expected to be less stable (more reactive) than "planar" cyclopentane. Explain this statement.

.....

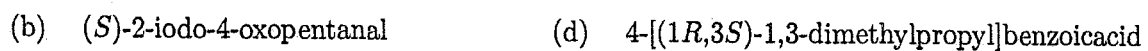
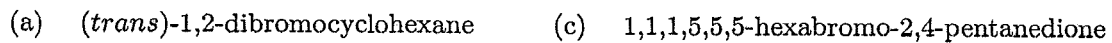
(4 marks)

7. Indicate whether each of the following pairs of compounds are identical, enantiomers, diastereomers, constitutional or conformational isomers.



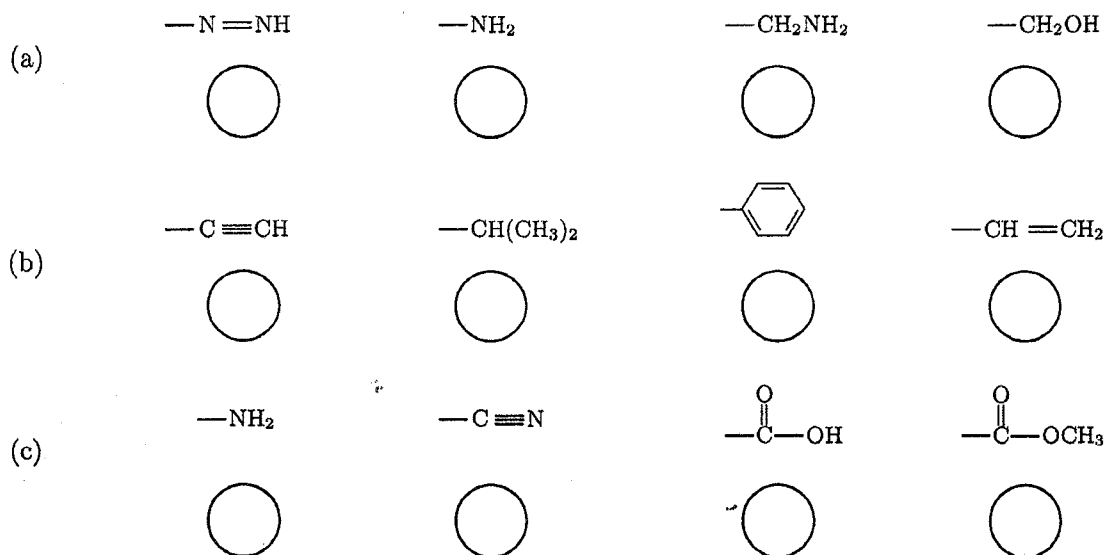
(5 marks)

8. Draw the chemical structure, showing stereochemical designations (*R*, *S*, *cis*, *trans*, *E*, *Z*) when required for the following molecules.



(7 marks)

9. Assign priority numbers to the following groups. Let the number 4 represent the group of lowest priority and the number 1 represent the group of highest priority.



(6 marks)

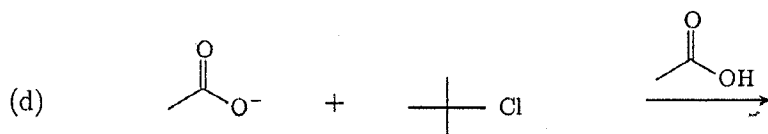
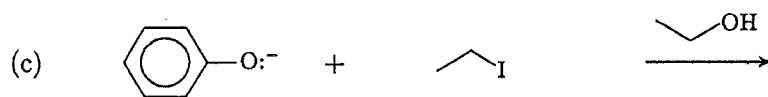
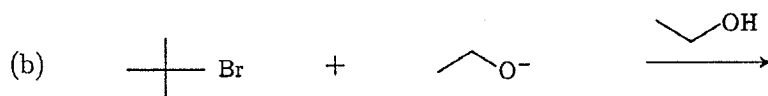
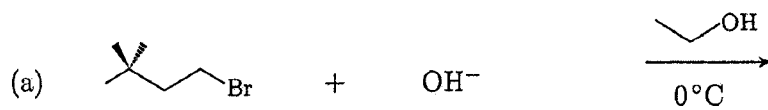
10. The specific rotation of enantiomerically pure (*S*)- bromobutane is $+23.1^\circ$. The observed specific rotation of a mixture of (*S*)- bromobutane and its (*R*) enantiomer was measured to be -9.2° .

(a) What is the enantiomeric excess (%ee) of the mixture?

(b) What percentage of the mixture is the *R* enantiomer?

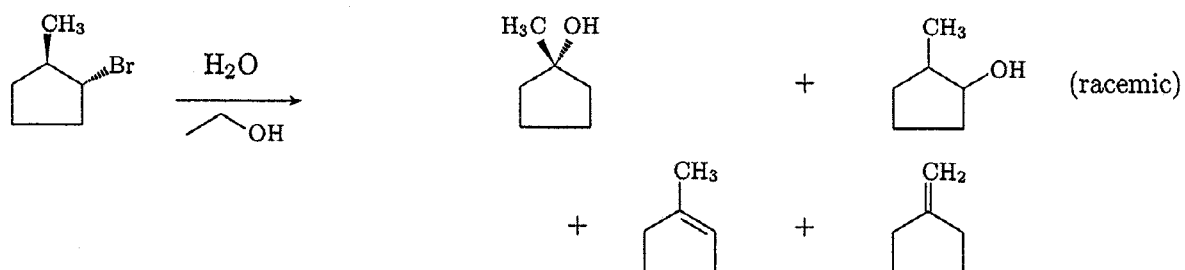
(6 marks)

11. From the reagents and solvents given, predict which reaction mechanism (S_N1 , S_N2 , E1, E2) is the most likely:



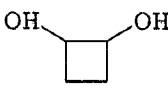
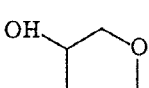


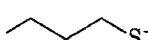
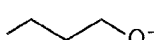
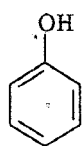
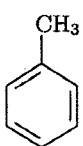
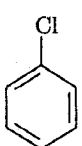
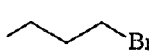
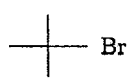
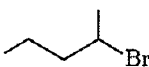
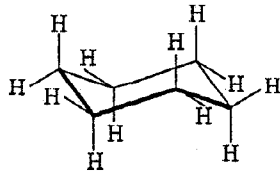
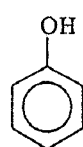
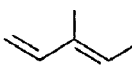
(4 marks)

12. Explain, using curved arrow mechanisms, the product mixture below. A few sentences to explain the products can help secure full marks for the question.



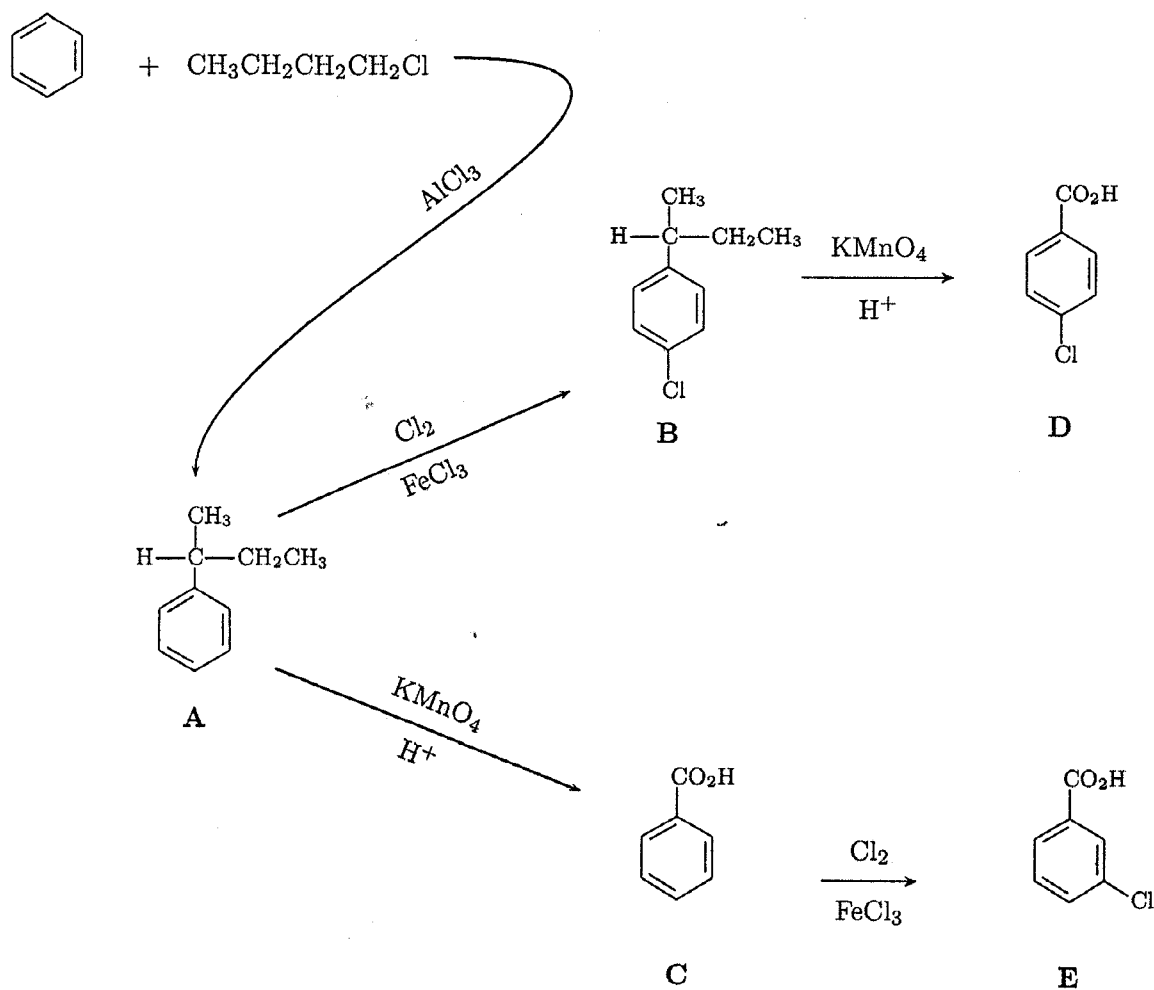
(10 marks)

13. Arrange the following sets of compounds in order with respect to the property indicated. To order each set of compounds, write 'most or highest', 'least or lowest', 'middle' in the spaces provided.

| | | | |
|---|---|---|---|
| (a) boiling point |  |  |  |
| | _____ | _____ | _____ |
| (c) nucleophilicity in methanol |  |  |  |
| | _____ | _____ | _____ |
| (d) rate of reaction with Cl ₂ and AlCl ₃ |  |  |  |
| | _____ | _____ | _____ |
| (e) rate of S _N 1 reaction |  |  |  |
| | _____ | _____ | _____ |
| (f) number of sp ³ hybridised carbons |  |  |  |
| | _____ | _____ | _____ |

(10 marks)

14. Examine the reaction scheme below and answer the questions which follow.



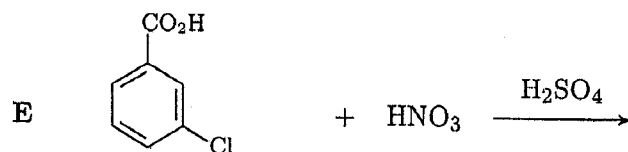
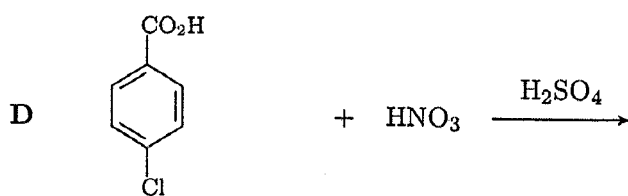
- (a) For this Friedel-Crafts alkylation of benzene, show all the steps in the mechanism (using curved arrows) in the formation of compound A. Be sure to account for the formation of the electrophile, the major product along with any minor product which may be formed.

(6 marks)

- (b) The reaction scheme above shows that in the treatment of compound **A**, when the sequence of reagents KMnO_4/H^+ and $\text{Cl}_2/\text{FeCl}_3$ is reversed different isomers **D** and **E** are produced. Account fully for this observation (no mechanism required).

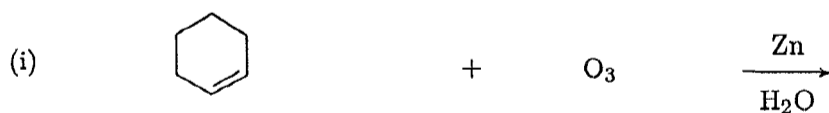
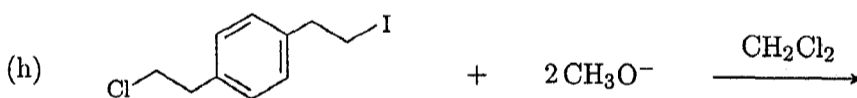
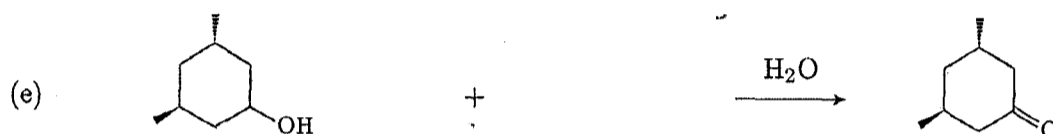
(6 marks)

- (c) If the compounds **D** and **E** are nitrated (show below), draw the structure of the dominant product(s) in each case.



(4 marks)

15. Add the major product(s) and/or reagents to complete the reactions below. Show stereochemistry where applicable.



† END OF EXAMINATION †

(10 marks)