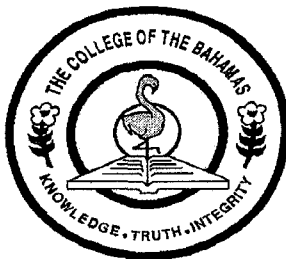


THE COLLEGE OF THE BAHAMAS



EXAMINATION

SEMESTER 04-2004

FACULTY OF PURE AND APPLIED SCIENCES
SCHOOL OF NATURAL SCIENCES AND ENVIRONMENTAL STUDIES

X NASSAU
FREEPORT
EXUMA
ELEUTHERA

DATE AND TIME OF EXAMINATION: Tuesday, 14 December 2004 at 9:00 a.m.
DURATION: 3 HOURS

COURSE NUMBER: Chem 230

COURSE TITLE: Organic Chemistry I

STUDENT NAME:

STUDENT NUMBER:

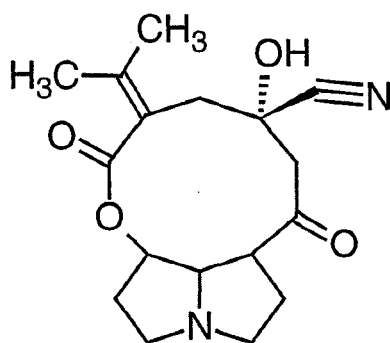
LECTURER'S NAME: Dr. D. Davis

INSTRUCTIONS TO CANDIDATES:

This examination paper consists of 13 questions on 6 pages (excluding this instruction page). Answer ALL questions in the spaces provided on the examination paper.

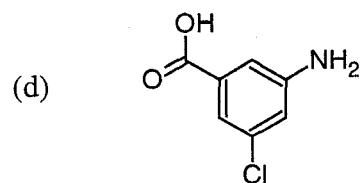
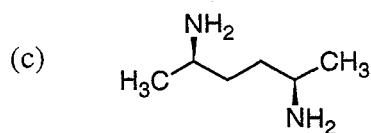
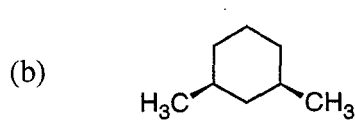
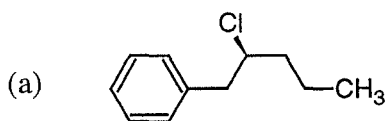
Only handheld calculators are allowed during this examination. The use of any other electronic device, e.g., cellular phones or PDA's, is strictly prohibited for the duration of this examination.

1. Circle and label all of the functional groups in the following molecule. It is not necessary to circle alkane groups.



[4 marks]

2. Give the systematic name of each of the following compounds. Include all stereochemical designations, *i.e.*, *cis*, *trans*, (*R*)-, (*S*)-, *etc.* as required.



[4 marks]

3. Draw the molecular structure for each of the following compounds. Show all stereochemical designations, *i.e.*, *cis*, *trans*, (*R*)-, (*S*)-, *etc.*, as indicated.

(a) (*R*)-3-chloro-2-butanone

(b) 1,5-dichloro-3-nitro-2-propylbenzene

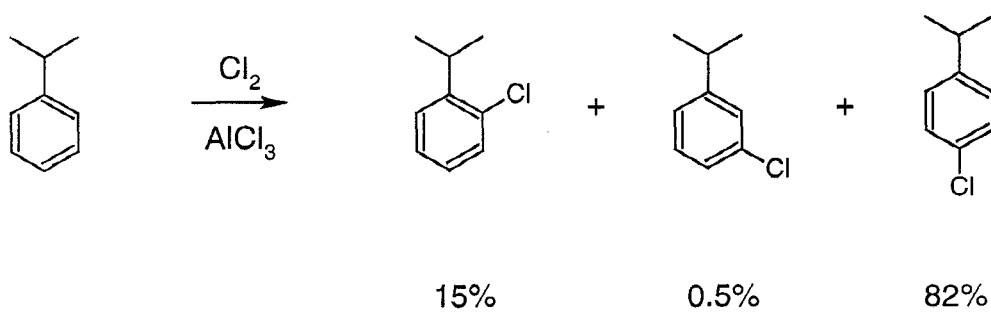
(c) ethyl 3-oxohexanoate

(d) *trans*-1,3-dimethylcyclobutane

[4 marks]



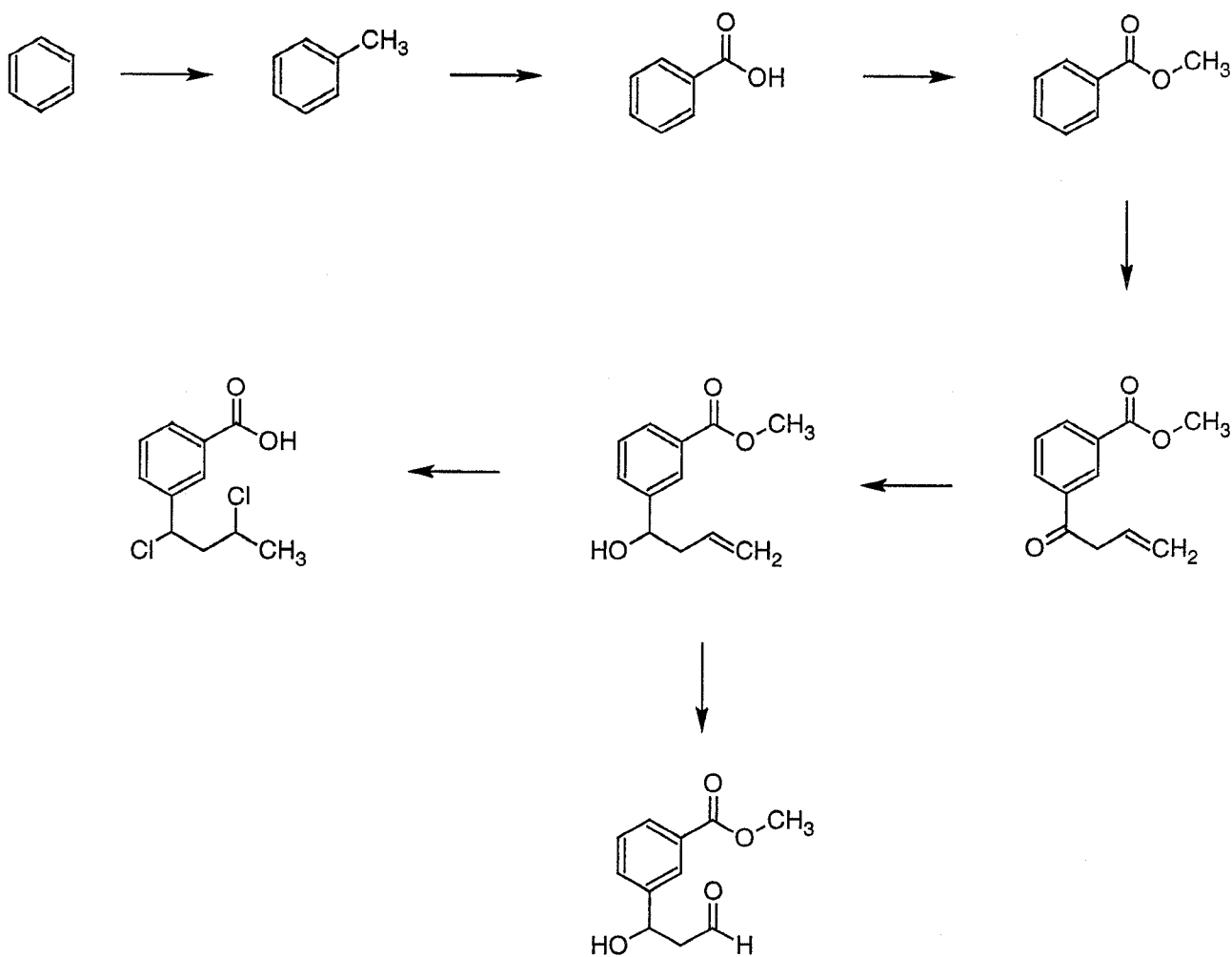
4. Draw the curved arrow mechanism to explain the formation of the product mixture shown below; your explanation must account for the relative abundances of the products.



[6 marks]

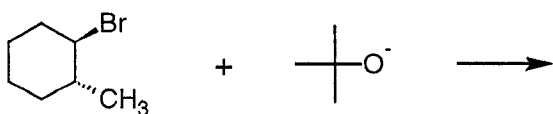


5. Add the necessary reagent(s) to complete each step in the following reaction sequence.



[7 marks]

6. A chemistry student (who obviously did not take Chem 230) attempted to prepare a sample of 1-methylcyclohexene by combining the reactants as shown below. To the students surprise the major product was 3-methylcyclohexene and not the desired product.

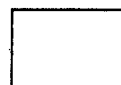


(a) Complete the equation above by drawing AND labeling the major and minor products.

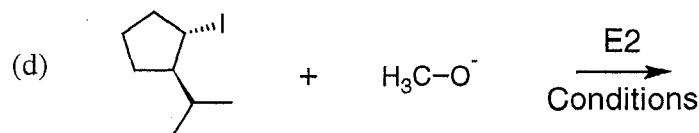
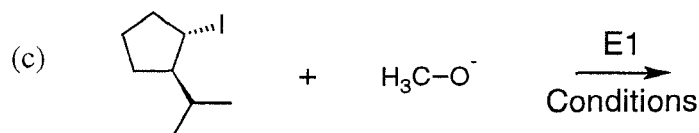
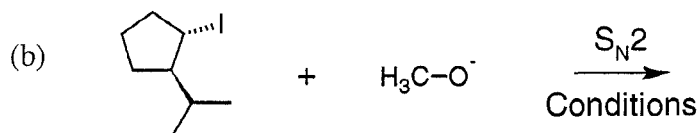
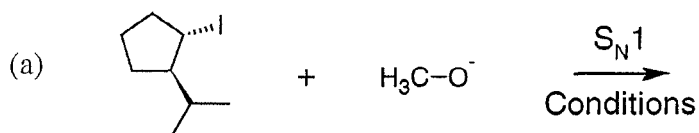
(b) Why was the desired product NOT the major product formed?

(c) Starting from any alkylhalide of your choosing, write a reaction equation that would yield 1-methylcyclohexene as the major product.

[5 marks]

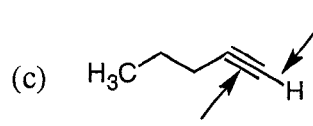
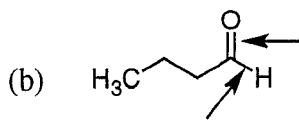
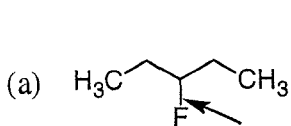


7. Draw the chemical structure of the major and, if applicable, the minor product(s) under the stated reaction conditions. In cases of major and minor products indicate the major product.



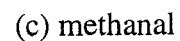
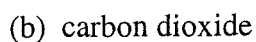
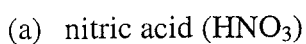
[7 marks]

8. Identify the type of bonding AND the orbitals involved in the highlighted bonds in the structures below.



[4 marks]

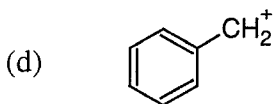
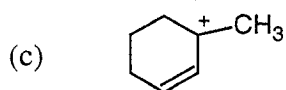
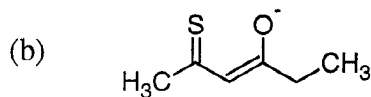
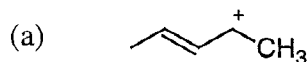
9. Draw the complete Lewis structure AND indicate the shape of the molecule in each structure for the following molecules:



[3 marks]



10. Draw all of the (reasonable) other resonance structure(s) AND indicate the most/more stable resonance contributor in each set of structures.



[8 marks]

11. Compound **X** ($C_8H_{18}O$) gave a negative result, *i.e.*, the solution remained orange-red, when treated with a CrO_3/H_2SO_4 solution. When **X** reacted with H_3PO_4 product **Y** was isolated. **Y** gave a positive test with $KMnO_4$, *i.e.*, the solution changed colour from purple to brown to colourless. Reaction of **Y** with H_2/Pt gave **Z** that had two stereogenic carbons. When **Y** was treated with ozone, 2-butanal was the only product identified. Draw the chemical structures for **X**, **Y** and **Z**. Note: There are 2 possible structures for **Y** based on the above information but you are only required to give one of the possible structures for **Y**. Show your reasoning.

X

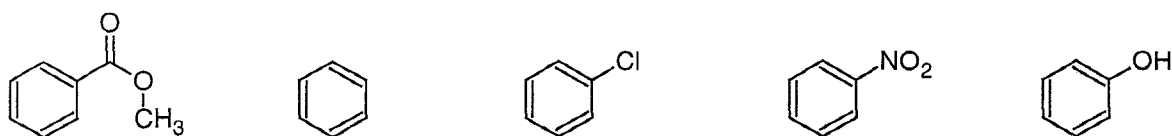
Y

Z

[3 marks]

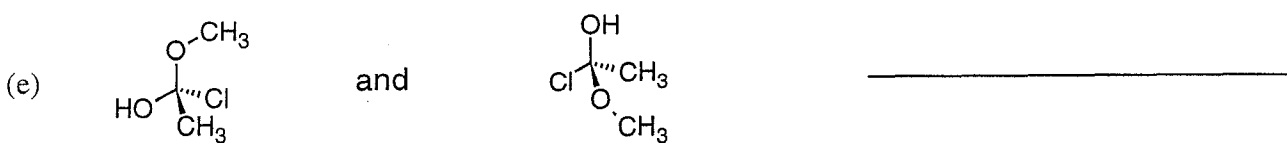
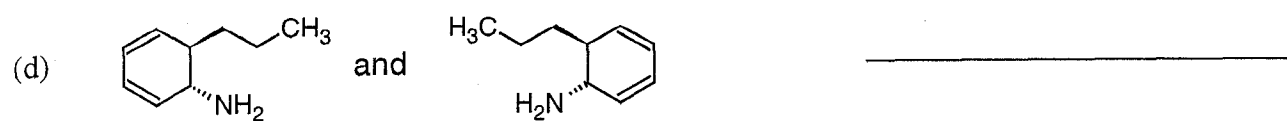
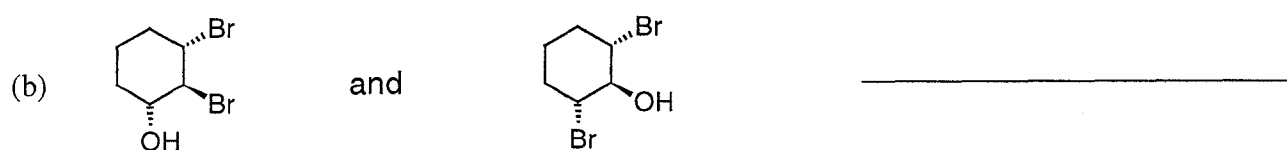
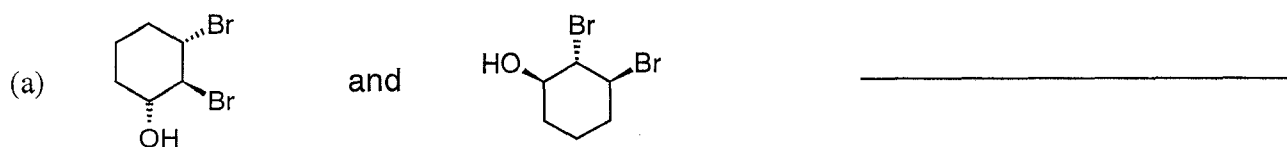


12. Arrange the following compounds in order of increasing reactivity in electrophilic aromatic substitution reactions. Let 1 represent the most reactive and 5 represent the least reactive species.



[2 marks]

13. Assign one designation of "identical", "enantiomers" or "constitutional isomers" to each pair of molecules below.



[5 marks]

***** End of Examination *****

