THE COLLEGE OF THE BAHAMAS

FINAL EXAMINATION SAMPLE

SEMESTER 01-2012

FACULTY OF PURE AND APPLIED SCIENCES
SCHOOL OF CHEMISTRY, ENVIRONMENTAL AND LIFE SCIENCES

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FREEPORT

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DATE AND TIME OF EXAMINATION: DATE & TIME

DURATION: 3 HOURS

COURSE NUMBER: Chemistry 230

COURSE TITLE: Organic Chemistry

STUDENT NAME:

STUDENT NUMBER:

LECTURER'S NAME: faculty name

INSTRUCTIONS TO CANDIDATES: This examination paper consists of ( ) pages (including this cover page) and ( ) sections. Follow the instructions at the beginning of each section.The use of any electronic devices *e.g.*, cellular phone or PDA, is strictly prohibited for the duration of this examination.

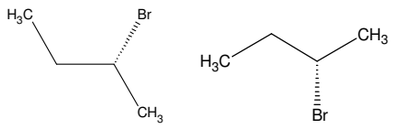
SECTION I: MULTIPLE CHOICE

Each question is followed by 4 options. Select the option that best answers / fits. Using an HB or #2 pencil, mark the space under the appropriate letter on the multiple choice answer sheet. Indicate your answer clearly.

Questions 1-5 are concerned with isomerism. Compare the two structures shown in each case and select the description from the list below, which best applies.

A. Constitutional isomers
B. Identical structures
C. Enantiomers
D. Geometric isomers

1.



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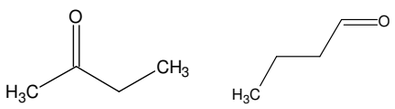

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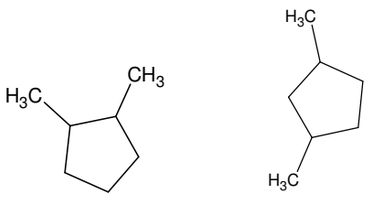

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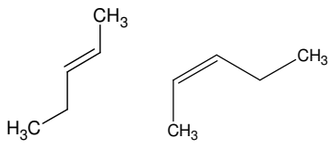

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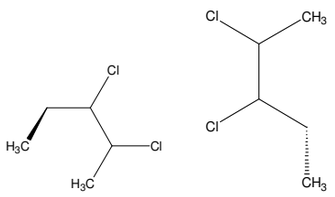
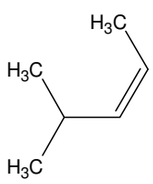
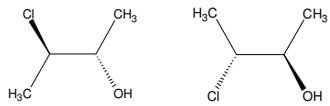


6. Name the structure shown below, applying IUPAC rules.



A. (2Z)-4-methyl-2-pentene
B. 4,4-dimethyl-4-butene
C. (2*E*)-4-methyl-2-pentene
D. Cis-2-methylpentene

7. Which of the following best describes the relationship between the two structures shown?



A. Meso compounds
B. Diastereomers
C. Geometric isomers
D. Enantiomers

8. Sodium reacts more vigorously with water than with ethanol because
   A. The O-H bond in water is stronger.
   B. The ethoxide ion is a weak base.
   C. Ethanol needs to be protonated to react.
   D. Water is a stronger acid than ethanol.

9. What role does Fe(III) halide play in the bromination of aromatic compounds ?

   A. Formation of a bromine radical
   B. Formation of an electrophilic Br^+
   C. It deactivates the bromine molecule
   D. It donates electrons to the benzene ring

10. Which of the following alkyl halides would undergo S_N2 reactions most rapidly ?

    A. 1-chlorohexane
    B. 2-chlorohexane
    C. 2-chloro-2-methylpentane
    D. 1-bromohexane

11. Which term best describes the type of reaction that occurs between cyclohexanol and concentrated phosphoric acid to form cyclohexene ?

    A. Electrophilic addition
    B. Nucleophilic substitution
    C. Elimination
    D. Radical addition

12. A reagent or test that could be used to distinguish between an alkene and an alkane would be

    A. Bromine liquid
    B. Lucas reagent
    C. pentene
    D. solubility in ethanol

13. Select the AROMATIC compound(s):

I  . II.  III.  + IV. 

A. II, III and IV
B. only IV
C. both I and IV
D . none of the compounds

14. How would the rate of an S_N1 reaction be affected if the concentration of both the alkyl halide and the nucleophile were tripled ?

A. It would not be affected.
B. It would be tripled.
C. It would increase 6 -fold.
D. It would increase 9-fold.

15. An example of a nonpolar solvent is

A. dichloromethane
B. 2-butanone
C. methanol
D. hexane

16. The C-H bond in butane can best be described as :

A. Polar with the carbon carrying a partial negative charge
B. Covalent with no polarity
C. Ionic with the carbon carrying a positive charge
D. Polar with the chlorine carrying a partial negative charge

17. A 50:50 mixture of B and C, two white crystalline solids was tested for melting point. It was found that the mixture melted between 102 and 107.5 ^{o}C. A pure sample of B was observed to melt between 110 and 110.2^{o} C . Which statement is most likely to be true ?

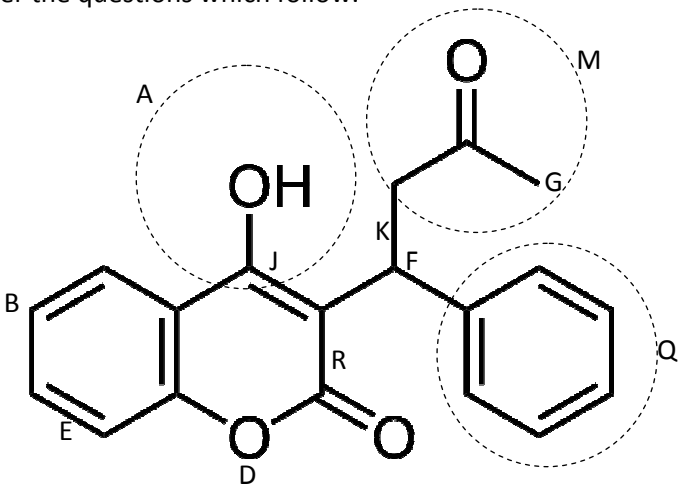
A. B and C have identical structures.
B. The mixture contains more C than B.
C. B contains a large proportion of contaminants.
D. None of the above is true.

18. Under specific conditions a primary alcohol can be oxidized to give an aldehyde. Which of the reagents given below would accomplish this ?

A. H_3PO_4
B. Jones' Reagent H_2CrO_4)
C. PCC
D. Lucas Reagent

SECTION II: Short Answer Questions .Answer questions in the spaces provided.

19. Examine the structure of the blood thinner Warfarin shown below. Selected functional groups are circled . Answer the questions which follow.

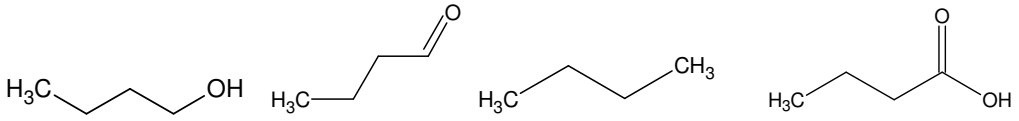


In each case select and write the letter that is next to the atom, group or bond which best fits the description. You may use each letter, several times or not as all, as needed. (4)

a. An sp^3 hybridized carbon
b. An aromatic group
c. A chiral centre
d. An sp^2 hybridized atom.
e. A primary carbon
f. A polar group
g. A sigma bond
h. A tertiary carbon

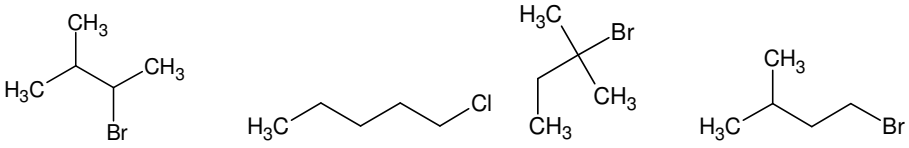
20. Using the numbers 1 (highest or fastest) to 4 (lowest or slowest) arrange the substances in order according to the property described. (2 marks each)

a. Boiling point



_____ _____ _____ _____

b. Rate of reaction under E2 conditions.

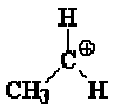
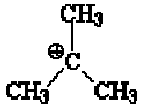
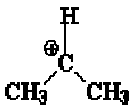
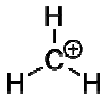


_____ _____ _____ _____

c. Priority in E,Z nomenclature

	$-NH_2$	-SH	$-CClH_2$	$-CH_2CHCl_2$
	_____	_____	_____	_____

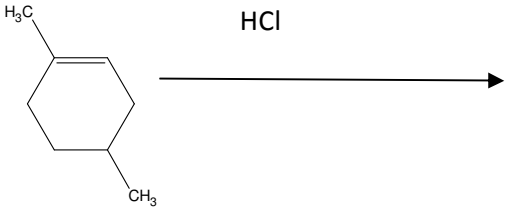
d. Stability

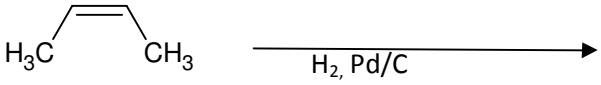
_____ _____ _____ _____

21. In each case, give the structure of the major organic product. Show stereochemical designations where appropriate. Mechanisms are not required. (5)

a.



b.



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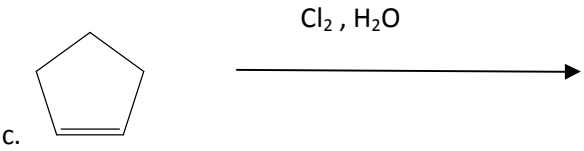

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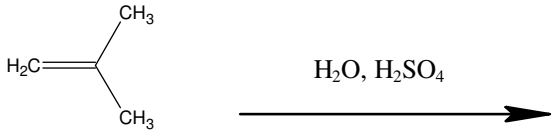
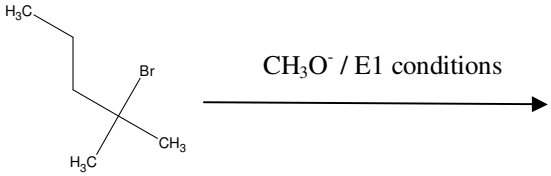


e .



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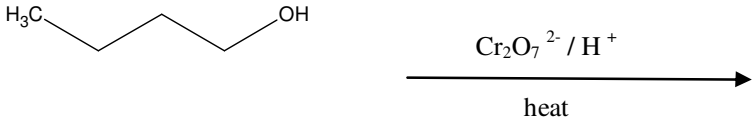
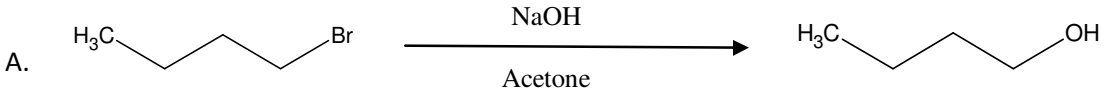
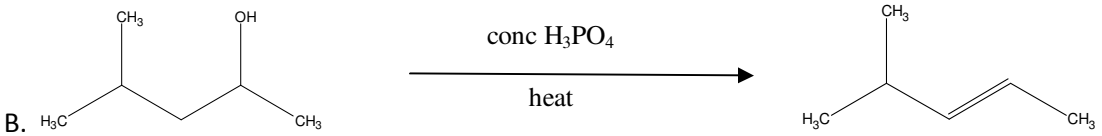


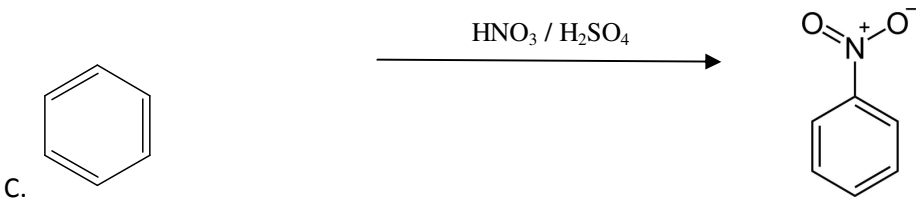
g.

SECTION III REACTION MECHANISMS

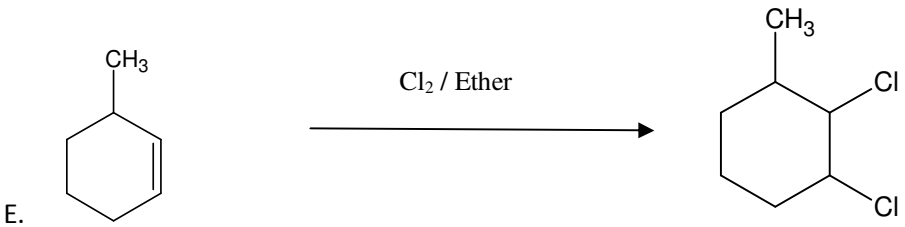
22. Illustrate the reaction mechanism for any FOUR of the following reactions. Note that only the major organic product is shown. Place your answers on the lined sheets provided. Write each mechanism on a separate sheet. (16 marks)

A. 

B. 

C. 

D. 

E. 

SECTION IV

23. Explain any TWO of the following observations. You may use illustrations to support your explanations. Each one is worth 3 marks.

A. Benzene does not readily undergo electrophilic addition reactions.

B. S_N1 reactions occur more rapidly in the presence of polar protic solvents.

C. Chlorobenzene undergoes electrophilic aromatic substitution more rapidly than benzene.

D. When 3,3-dimethyl-2-butanol undergoes a dehydration reaction, the major product is 2,3-dimethyl-2-

butene and 3,3-dimethyl-1-butene is a minor product.

END OF SAMPLE EXAMINATION

Comments :
You should be able to give mechanisms for S_N1, S_N2, E1, E2, alcohol dehydration , alcohol oxidation, electrophilic addition, radical substitution, electrophilic aromatic substitution and ozonolysis reactions.
You should be able to explain trends in boiling point, solubility, leaving group ability, carbocation stability and alkene stability.
You should be able to discuss the effects of nucleophile strength, base strength,steric hindrance and solvent polarity and protic nature on reaction rates.
Remember that bond cleavage is HETEROLYTIC in most of the reactions you have met. In radical mechanisms however bond cleavage is HOMOLYTIC (each side of the bond gets a single electron from the bond pair).
Note that this paper is slightly shorter than your actual final examination.
There will be more multiple choice questions.

FOR MAXIMUM BENEFIT You should answer all questions. If you find a question difficult, then you should spend more time reviewing work on that topic.