

KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

MAY INTAKE SEMESTER LEVEL I EXAMINATION FOR THE DEGREE OF BACHELOR OF PHARMACY

SCH 130: CHEMISTRY III

DATE: Monday 25th July, 2011

TIME: 8.00 a.m. – 10.00 a.m.

Instructions

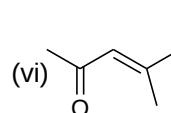
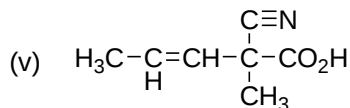
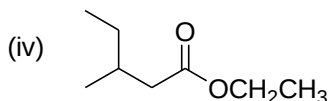
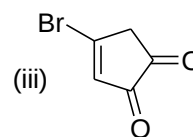
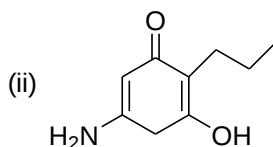
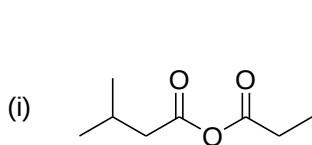
Answer all questions. Each section should be answered in a separate booklet

SECTION A

Q1.(a) Draw structures of each of the following compounds and indicate stereochemistry where necessary (5 mks)

- (i) (E)-3-Bromopropenal
- (ii) 3-Chloro-2,4-dimethyl-5-hydroxy-pentanoic acid δ lactone
- (iii) N,N-dimethylbutanamide
- (iv) 2-chloropropanoyl bromide
- (v) 2-Hydroxy-3-methyl-2-cyclopentenone

(b) Write the IUPAC names for the following compounds including stereochemistry where possible. (6 mks)

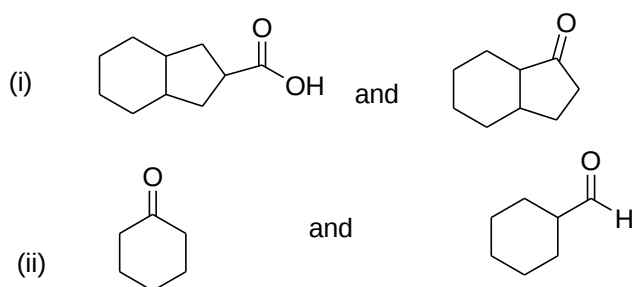


Q2. (a) Explain the following using appropriate equations and/or structures. (6 mks)

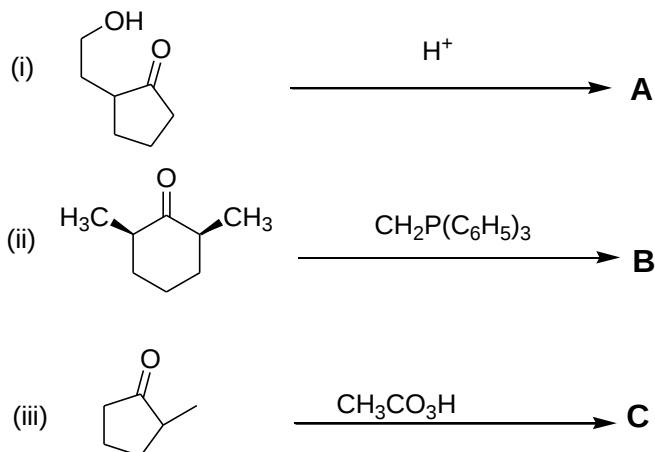
- (i) Propanal is more reactive than propanone towards nucleophilic addition reactions.
- (ii) Amines are more basic than amides and the basicity depends on the number of alkyl groups attached to nitrogen
- (iii) 2,4-Pentanedione in hexane exists exclusively as 4-hydroxy-3-penten-2-one.

(b) Give a simple visual chemical test, including observations that you would use to differentiate between each of the following pairs of compounds.

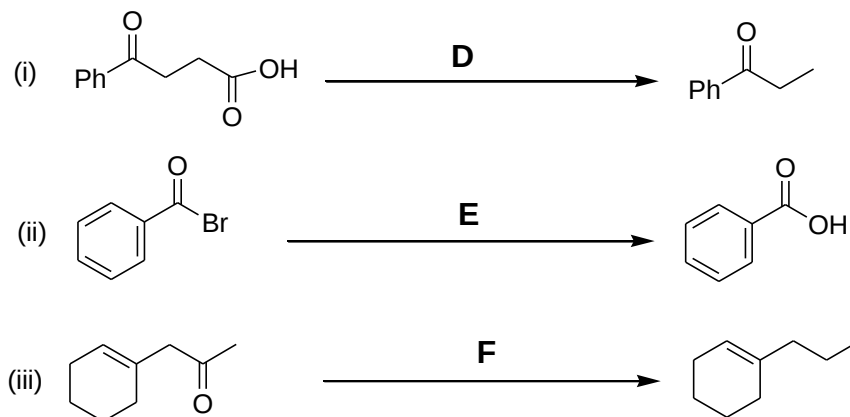
(4mks)



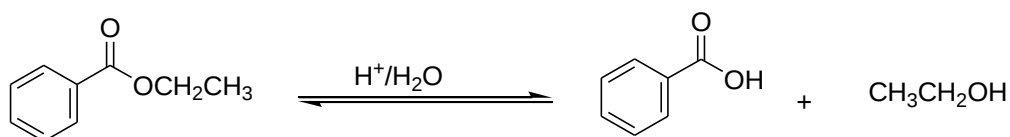
Q3 (a) Provide the structure of the major organic compounds **A-C** that are expected in the following reactions. (3 mks)



(b) Suggest the missing reagents **D** to **F** you would use to carry out the following transformations. (3 mks)



(c) Using curly arrows, write a possible mechanism for the reaction below (3 mks)



SECTION B

Useful constants: $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$; $h = 6.626 \times 10^{-34} \text{ Js}$; $c = 3.0 \times 10^8 \text{ ms}^{-1}$

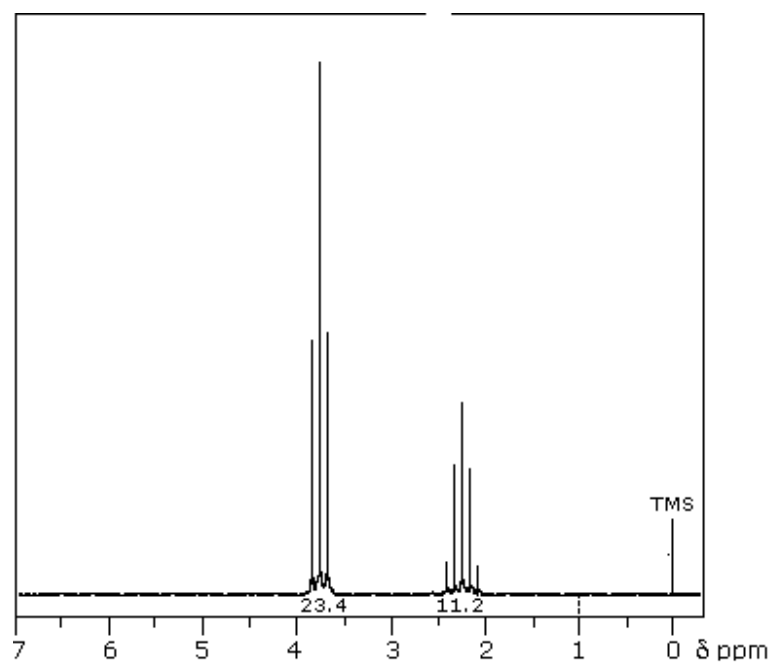
1. A solution of 4-methyl-3-penten-2-one in ethanol shows an absorbance of 0.52 at 236 nm in a cell with a 1-cm light path. Its molar absorptivity in ethanol at that wavelength is 12,600. What is the concentration of the compound? (2 marks)
2. Flames can attain temperatures of 3000 K while inductively coupled plasmas can have temperatures of 10,000 K. How much more sensitive is plasma atomic emission spectroscopy compared to flame emission spectroscopy when the emission line has a wavelength of 700 nm?

Note: Boltzmann distribution:

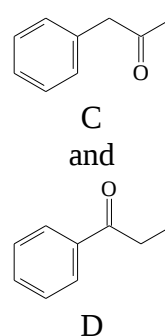
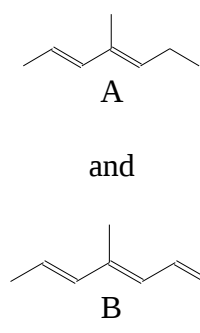
$$\frac{n_2}{n_1} = \exp\left(-\frac{\Delta E}{kT}\right)$$

(5 marks)

3. A compound with molecular formula $\text{C}_3\text{H}_6\text{Cl}_2$ has the NMR spectrum shown below. Suggest a structure for the compound, explaining your reasoning (7 marks)



4. Briefly describe the principle of mass spectrometry (4 marks)
5. Using vibrations of bonds in carbon dioxide as an example, explain why Infrared and Raman spectroscopy are complementary techniques. (5 marks)
6. a) Give a spectroscopic explanation as to why an acid-base indicator changes colour as pH is altered. (2 marks)
- b) Explain the differences you would expect between the UV-Vis spectra of the compounds in each of the following pairs? (4 marks)



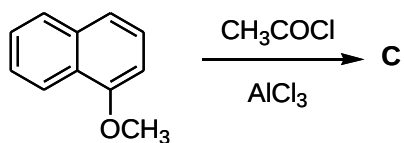
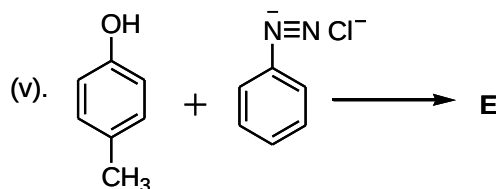
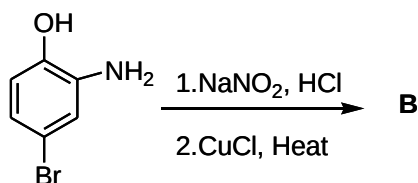
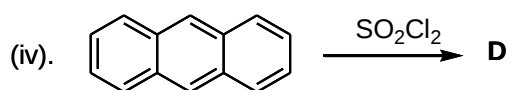
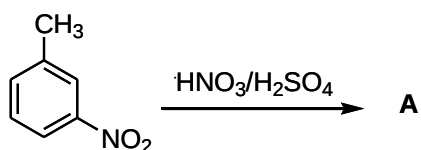
- c) Why is electron spin resonance spectroscopy especially suited to reaction mechanism studies? (1 mark)

SECTION C

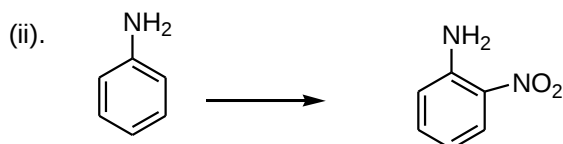
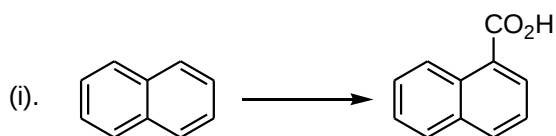
Q1. (a). Draw the structures of the following aromatic compounds [5 marks]

- (i) 3-bromo-5-nitrobenzene sulfonic acid
- (ii) 2-chloro-4-ethoxybiphenyl
- (iii) 4-amino-2-ethylbenzoylbromide
- (iv) 8-cyano-2-anthrol
- (v) 1-phenyl-2-(3'-chlorocyclobutyl)butane

(b). Draw the structure of the major organic compound in each of the following transformations (A-E) [5 marks]



Q2. (a). Using reaction schemes (step by step), show how the following conversions can be achieved [8 marks]



(b). Identify any two aromatic compounds that are found in natural systems. [2 marks]

Q3. (a). With the aid of reaction mechanisms and resonance structures, explain the following observations [6 marks]

(i) A nitro group on benzene ring is a meta director for an incoming electrophile

(ii) In mono bromination of naphthalene, 1-bromonaphthalene is exclusively formed and not 2-bromonaphthalene

(b). Arrange the following aromatic compounds in order of increasing reactivity towards electrophilic aromatic substitution. Give reasons for the order of arrangement [4 marks]

