

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATION

RESIT/SPECIAL EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE

CHEM 231: ORGANIC CHEMISTRY II

STREAMS:

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 03/02/2021

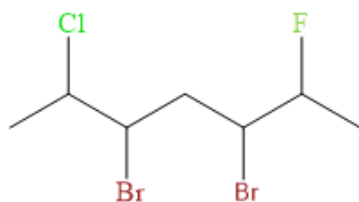
5.00 P.M – 7.00 P.M

INSTRUCTIONS:

Answer question one and any other two questions

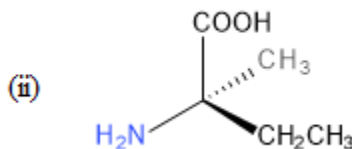
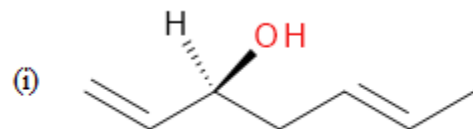
QUESTION ONE [30 MARKS]

(a) Identify stereogenic centres (if any) in the following compound. Determine the maximum number of isomers possible (2 ½ Marks)



(b) Assign compounds

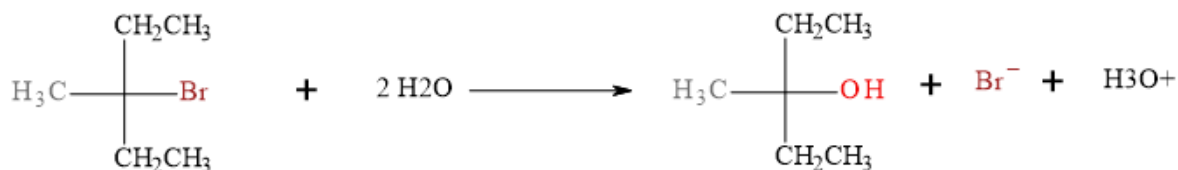
the R/S configuration to the following (4 Marks)



(c) Predict the **major** organic product and the corresponding mechanism (SN1, SN2, E1 or E2) of each of the following reactions (4 Marks)

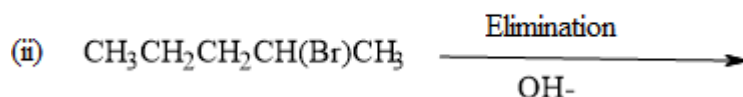
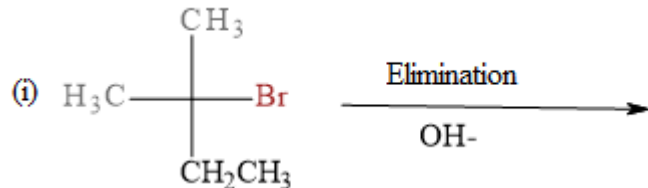
- (i) 1-bromohexane + sodium ethoxide in ethanol (ii) 2-chloro-2-methylbutane + sodium ethoxide in ethanol (iii) Isobutyl iodide + KOH in ethanol/water (iv) 1-bromo-1-methylcyclopentane + sodium ethoxide

(d) Consider the following reaction:



- (i) Write the stepwise mechanism (3 Marks)
 (ii) Draw a well labelled energy diagram (3 Marks)
 (iii) Explain the stereochemical outcome (2 Marks)
 (iv) Write the rate law expression (1/2 Mark)

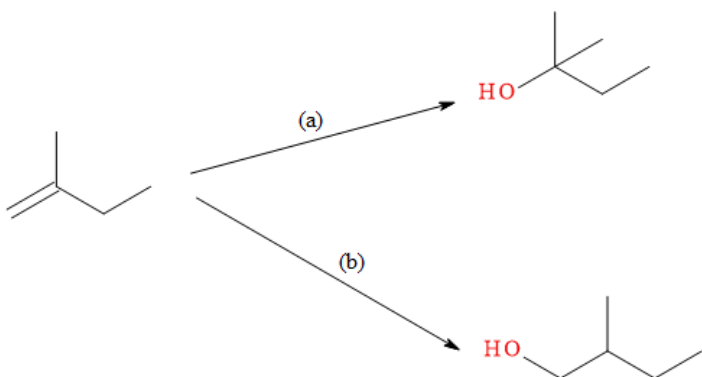
(e) Predict the major organic product(s) of each of the following elimination reactions. In each case, explain your rationale and state the most likely mechanism of the reaction (4 Marks)



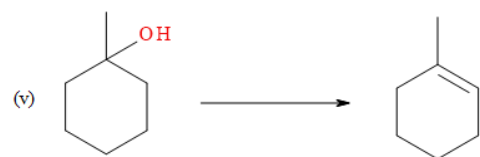
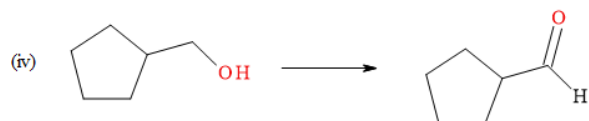
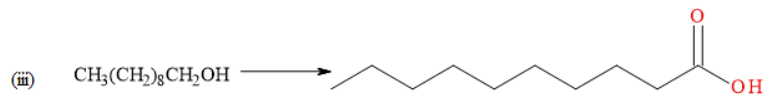
(f) Explain the following observations

- (i) Low molecular weight alcohols are highly soluble in water (1 Mark)
 (ii) Alcohols have higher boiling points than hydrocarbons of similar molecular weights (1 Mark)
 (iii) Solubility of alcohols decrease as the number of carbon atoms increase (1 Mark)

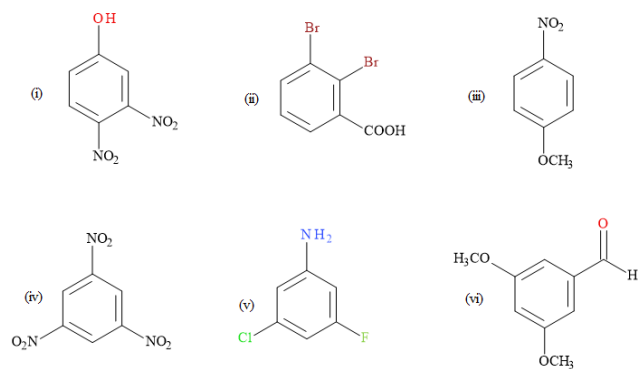
(g) Give the reagent(s) and condition(s) used for the following transformations (4 Marks)

**QUESTION TWO [20 MARKS]**

(a) Give the reagent(s) and condition(s) for the following transformations (5 Marks)



(b) Write the IUPAC names of the following compounds (6 Marks)

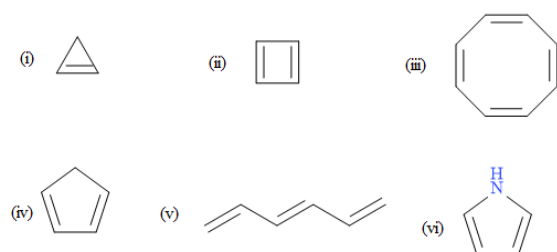


(c) State Hückel law of aromaticity

(3 Marks)

(d) Classify the following compounds as aromatic, antiaromatic, or nonaromatic. In each case justify your answer

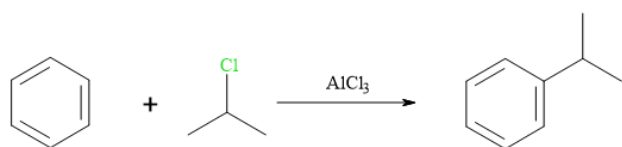
(6 Marks)



QUESTION THREE [20 MARKS]

(a) Write the mechanism of the following reaction

(3 Marks)



(b) With the aid of relevant resonance structures, explain why halo groups (F, Cl, Br, I) are deactivating, ortho-para directors

(5 Marks)

(c) Predict the major organic product obtained when each of the following compounds is treated with fuming sulfuric acid

(5 Marks)

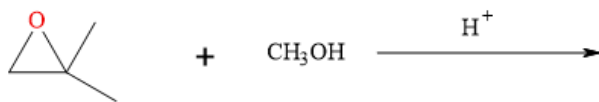
(i) Chlorobenzene (ii) Benzaldehyde (iii) *o*-Nitrophenol (iv) *p*-Ethyltoluene
(v) *p*-Bromotoluene

(b) Discuss the physical and chemical properties of ethers

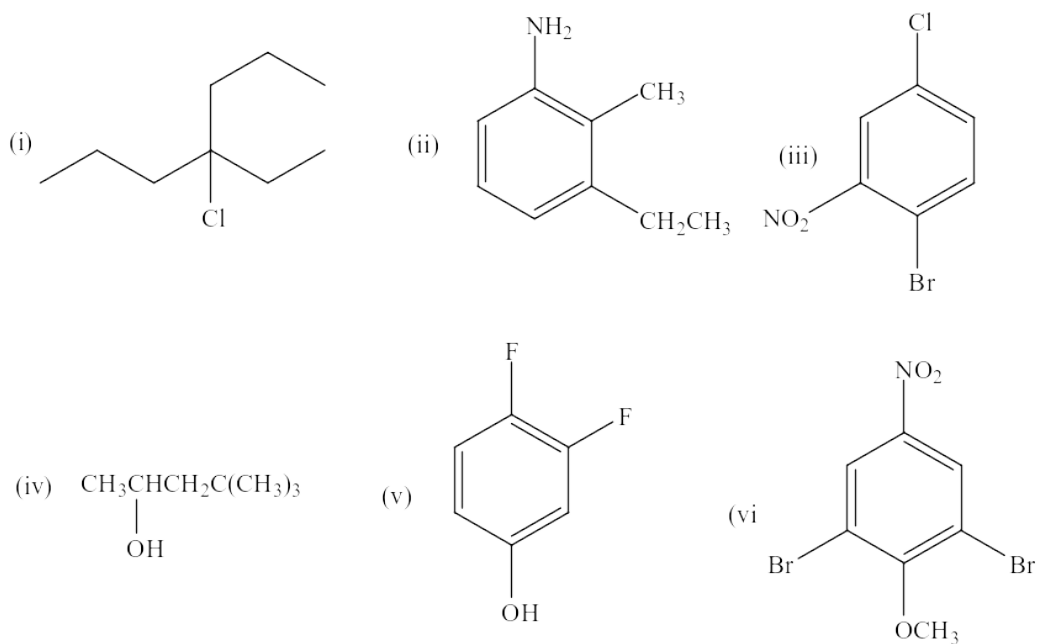
(3 Marks)

(c) Give the organic product and the mechanism of the following reaction

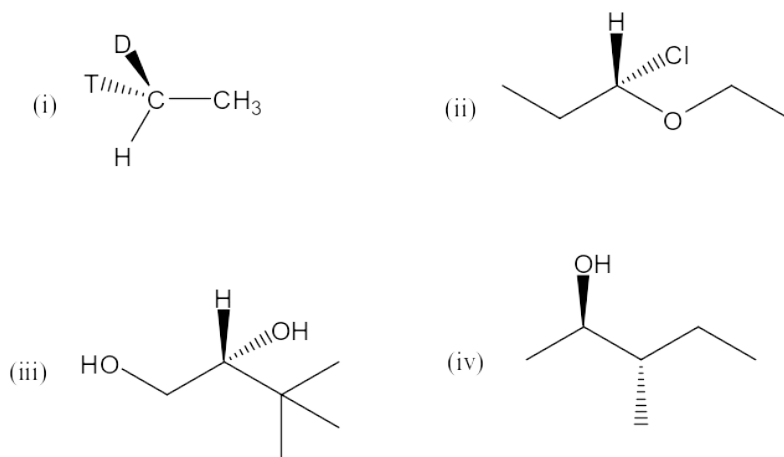
(4 Marks)

**QUESTION FOUR [20 MARKS]**

(a) Write the IUPAC name of each of the following organic compound (6 Marks)

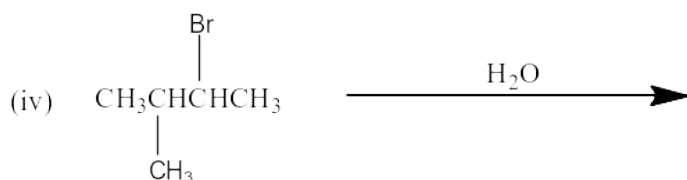
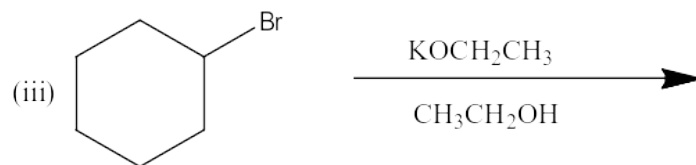
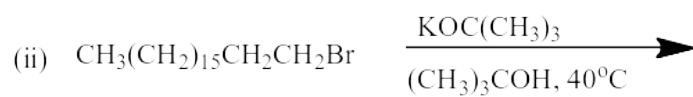
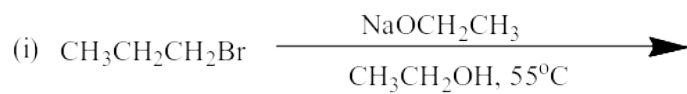


(b) Determine the R/S configuration(s) of each the following molecules (5 Marks)



(c) When 1.30 g of menthol is dissolved in 5.00 mL of ether and placed in a sample cell 10.0 cm in length, the observed rotation at 20°C (using the D line of sodium) is +0.57°. Calculate the specific rotation of menthol (2 Marks)

(d) Predict the major organic product(s) of each of the following reactions (4 Marks)



(e) Describe, with the aid of a suitable example, two methods that can be used for laboratory synthesis of alcohols (3 Marks)
