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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017**

COURSE NAME : ORGANIC AND PHYSICAL
CHEMISTRY
COURSE CODE : DAK 11303/DAK10303
PROGRAMME : 1 DAK
EXAMINATION DATE : DECEMBER 2016/JANUARY 2017
DURATION : 3 HOURS
INSTRUCTION : **SECTION A : ANSWER ALL
QUESTIONS**
**SECTION B : ANSWER TWO (2)
QUESTIONS ONLY**

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THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

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SECTION A

- Q1** (a) Distinguish between atoms and molecules. (4 marks)
- (b) Urea $[(\text{NH}_2)_2\text{CO}]$ is used for fertilizer and many other things. Calculate the number of N, C, O and H atoms in 1.68×10^4 g of urea. (Relative atomic mass C=12; O = 16; H = 1 ; N=14). (10 marks)
- (c) All alkali metals react with water to produce hydrogen gas and the corresponding alkali metal hydroxide. A typical reaction is between lithium and water.
- (i) Write the balance equation representing the reaction. (2 marks)
- (ii) Calculate the amount of H_2 in grams will be formed by the complete reaction of 85.57g of Li with water. (Relative atomic mass of Li = 6.94 ; H = 1 ; O = 16). (9 marks)
- Q2** (a) Rates of reaction can be determined by monitoring the change in concentration of either reactant or product as a function of time. Explain **Three (3)** factors that affect the reaction rates. (6 marks)
- (b) Iodine atoms combine to form molecular iodine in the gas phase
- $$\text{I (g)} + \text{I (g)} \longrightarrow \text{I}_2 \text{ (g)}$$
- This reaction follows second order kinetics and has the high rate constant $7 \times 10^9 / \text{Ms}$ at 23°C .
- (i) If the initial concentration of I was 0.086M, calculate the final concentration after 2 minutes. (5 marks)
- (ii) Calculate the half-life of the reaction if the initial concentration of I is 0.60M and if it is 0.42M. (6 marks)
- (c) The rate constant of a first order reaction is $3.46 \times 10^{-2} \text{ s}^{-1}$ at 298K. Calculate the rate constant at 350K if the activation energy for the reaction in 50.2 kJ/mol. (8 marks)

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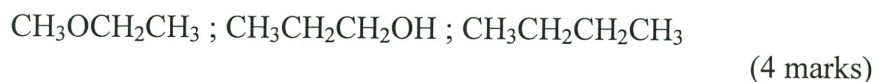
SECTION B

- Q3** (a) Rank the following terms of their boiling points.
- (i) 1-butanol ; Butanoic acid ; Ethyl Acetate. (3 marks)
 - (ii) N-butylamine ; Diethylamine ; N,N-dimethyl ethylamine. (3 marks)
- (b) Draw the structure of each following compound.
- (i) 3,4-dibromoaniline.
 - (ii) N,N-Diethylmethylamine.
 - (iii) Cyclopentylamine.
 - (iv) 2-ethylhexanoic acid.
 - (v) 2-hydroxybutanoic acid.
 - (vi) 3,3-dihydroxybenzoic acid. (12 marks)
- (c) The IR spectrum as indicated in **Figure Q1 (c)** is for $C_4H_8O_2$.
- (i) Identify and label **A**, **B**, **C** and **D** peaks in the spectrum (**Figure Q1 c**) which are consistent with the molecular formula given. (4 marks)
 - (ii) Explain briefly if there are containing carboxylic acid molecules from the IR spectrum in **Figure Q1 (c)**. (3 marks)

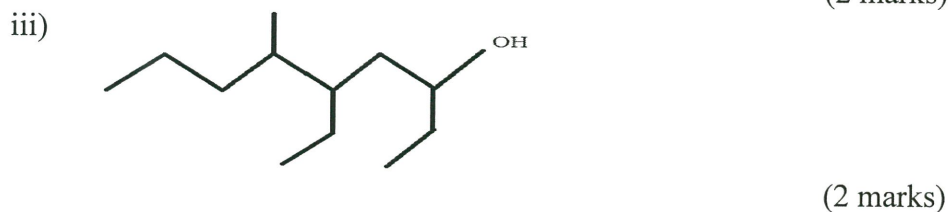
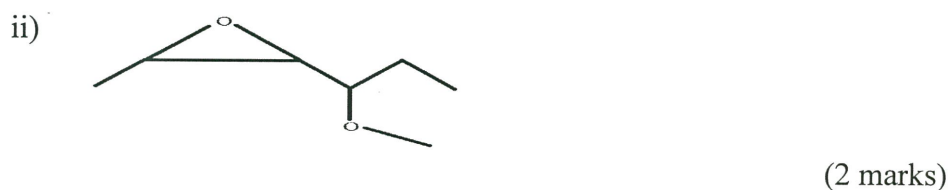
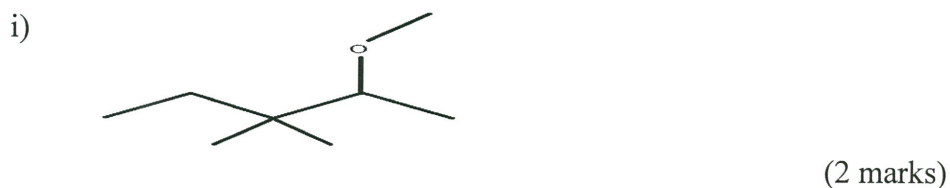
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Q4 (a) State the Le Châtelier's principle. (1 marks)

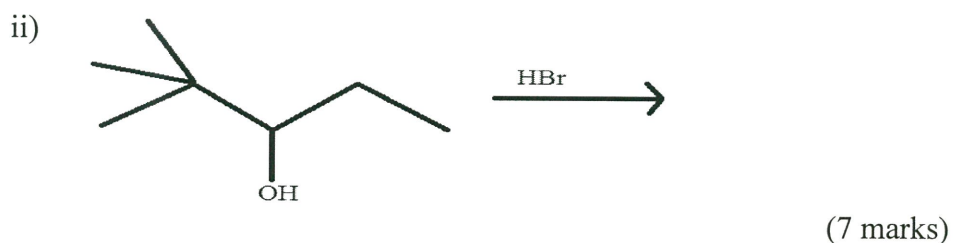
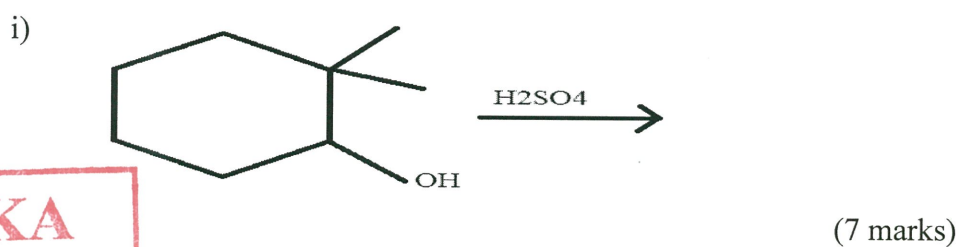
(b) Rank each group of compound in order of increasing boiling point and justify the answer.



(c) Naming the IUPAC name for each compound.



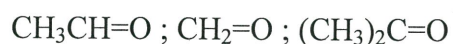
(d) Draw stepwise mechanism for the following reaction and explained if the reaction occurs via $\text{S}_{\text{N}}1$, $\text{S}_{\text{N}}2$, $\text{E}1$ or $\text{E}2$.



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Q5 (a) (i) Describe the reason for a large difference in the boiling point of butanal and butanol. (1 marks)

(ii) Rank the compounds in order of increasing reactivity towards nucleophilic attack and justify your answer.



(4 marks)

(b) Draw the structure of the following compounds.

(i) Acetaldehyde.

(2 marks)

(ii) Acetophenone.

(2 marks)

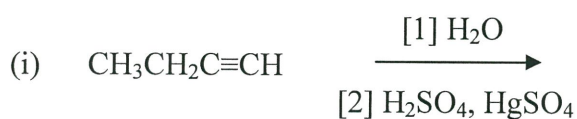
(iii) 2-Methylcyclopentanone.

(2 marks)

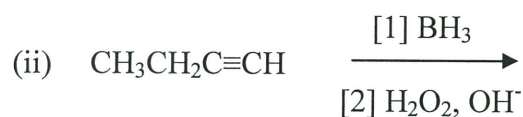
(iv) 7-Hydroxyoctanal.

(2 marks)

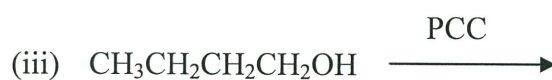
(c) Draw the product from each of the following reaction.



(2 marks)



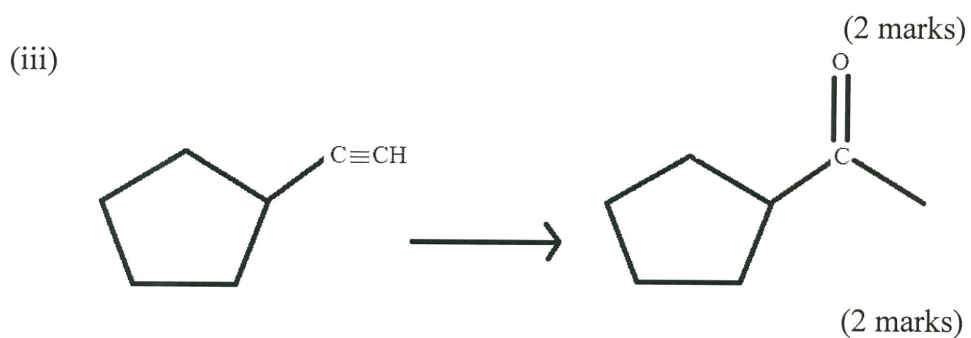
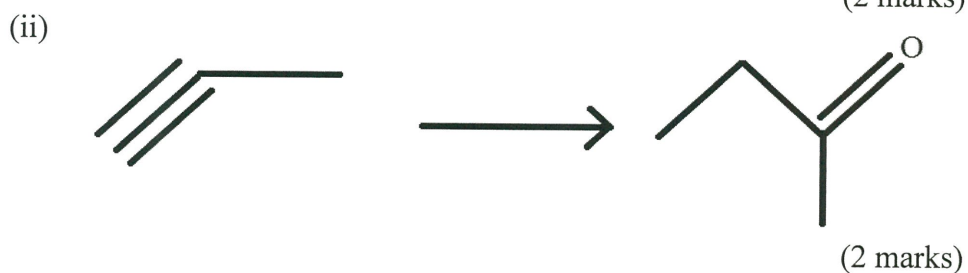
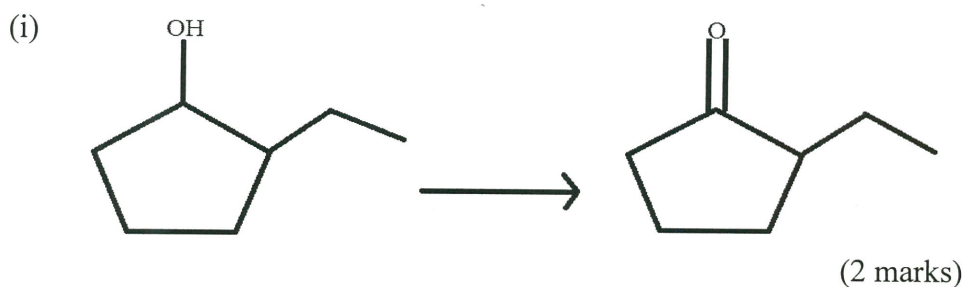
(2 marks)



(2 marks)

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- (d) Predict the reagent needed to convert each compound into aldehyde and ketone.



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- Q6** (a) Distinguish between alkanes, alkene and alkynes. (6 marks)
- (b) Identify the correct IUPAC name for the following compound and show why the IUPAC names is incorrect.
- (i) 1,3-dimethylbutane.
 - (ii) 2-butyl-3-methyl-1-pentene.
 - (iii) 5-methylcyclohexene.
 - (iv) 4-isobutyl-2-methylcyclohexene.
 - (v) 2-methyl-2-isopropylheptane.
- (10 marks)
- (c) Point out **THREE (3)** structure and IUPAC name for each constituent isomers having molecular formula C_8H_{18} that contains six carbon in the longest chain and two methyl groups as substituents. (9 marks)

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-END OF QUESTIONS-

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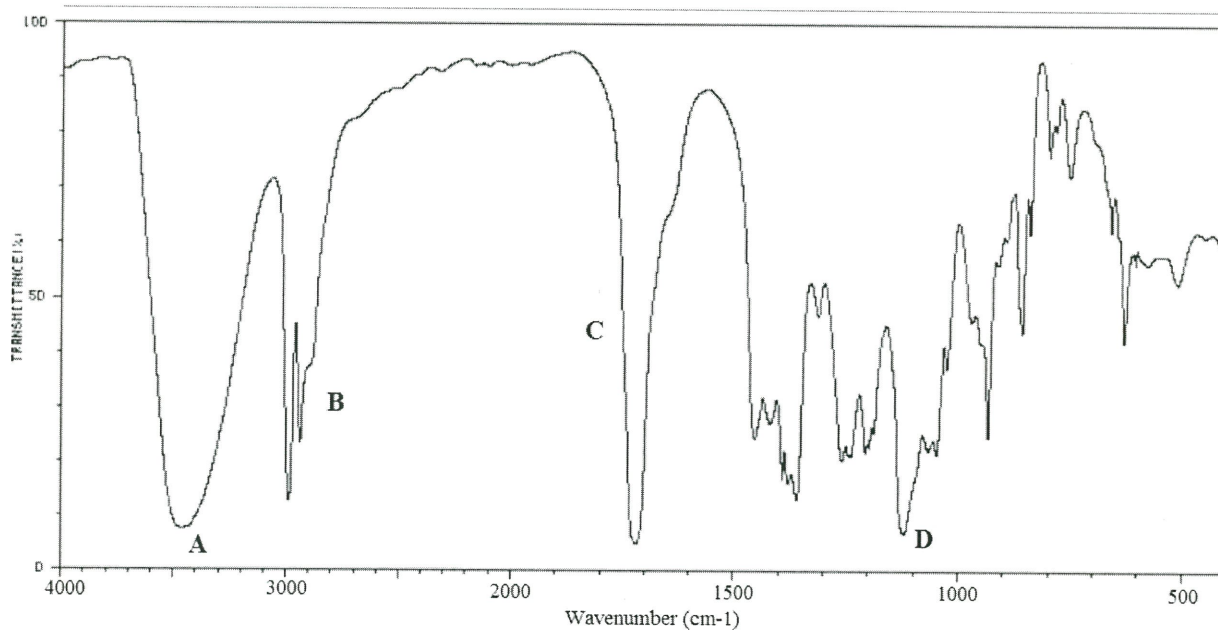


Figure Q1 (c)

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Some useful equation

$$\ln \frac{k_1}{k_2} = \frac{E_a}{R} \left(\frac{T_1 - T_2}{T_1 T_2} \right)$$

$$\frac{1}{[A]} = \frac{1}{[A]_0} + kt$$

$$t_{1/2} = \frac{1}{k[A]_0}$$

Universal gas constant = 0.0821 L.atm/mol.K = 8.314 J/mol.K

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