INTI International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	AUGUST 2019
Programme	:	Foundation in Science (CFSI)
Course	:	**CHM 1204 : CHEMISTRY 2**
Date of Examination	:	11 December 2019 (Wednesday)
Time	:	8:00AM – 10:00AM Reading Time : Nil
Duration	:	2 hours
Special Instructions	:	

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Periodic Table

Examiner(s)	:	**Ms. Lim Sze Theng**
Moderator	:	**Dr. Lim Gin Keat**

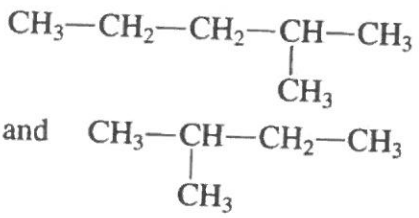
*This paper consists of **12** printed pages, including the cover page.*

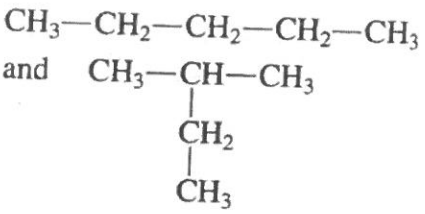
INTI INTERNATIONAL COLLEGE PENANG
FOUNDATION IN SCIENCE (CFSI)
CHM1204: CHEMISTRY 2
FINAL EXAMINATION: AUG 2019 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

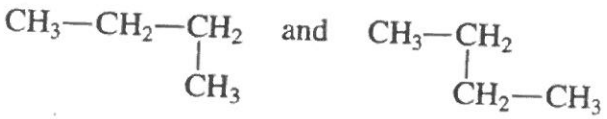
Question 1

(a) For each of the following pairs of structures, determine whether they are
1. Different conformations of the same molecule
2. Different compounds that are constitutional isomers.
3. Different compounds that are not constitutional isomers.

(i) 

(ii) 

(1 mark)

(iii) 

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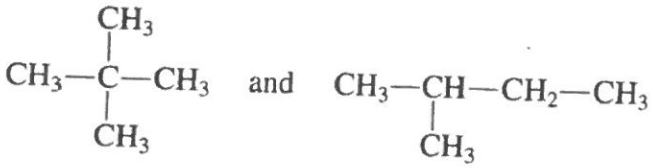
(iv) 

(1 mark)

(1 mark)

(b) Which member of each of the following pairs of compounds would you expect to have higher boiling point? Explain your answer.

(i) 1-butanol and 1-heptanol

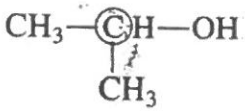
(ii) butane and 1-propanol (2 marks)

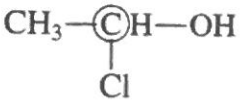
(iii) ethanol and 1,2-ethanediol (2 marks)

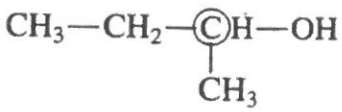
(2 marks)

(c) Indicate whether the circled carbon atom in each of the following molecules is a chiral center.

(i) $CH_3—\textcircled{C}H_2—OH$

(ii)  (1 mark)

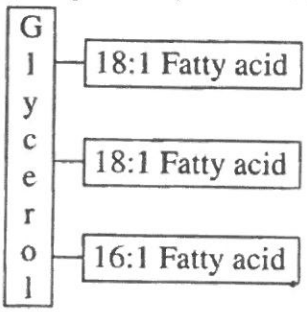
(iii)  (1 mark)

(iv)  (1 mark)

(1 mark)

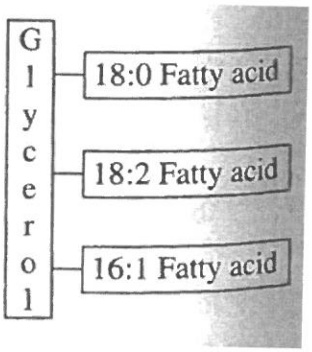
(d) Draw block diagram structures for all possible products of the partial hydrogenation, with two molecules of H_2, of the following molecules.

(i)



(3 marks)

(ii)



(3 marks)

(e) Two proteins with the same amino acid composition do not have to have the same primary structure. Explain why.

(1 mark)

(f) How many different primary structures are possible for a four-amino-acid segment of a protein if the segment contains

(i) Two glycine units and two alanine units

(2 marks)

(ii) Two glycine units, one alanine unit and one valine unit

(2 marks)

(TOTAL: 25 MARKS)

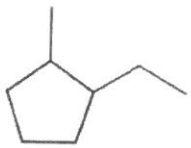
Question 2

(a) What is the molecular formula for each of the following cycloalkane molecules?

(i)

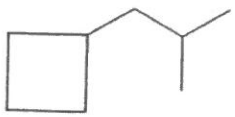
(1 mark)

(ii)



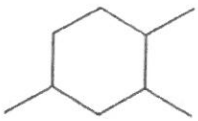
(1 mark)

(iii)



(1 mark)

(iv)



(1 mark)

(b) Draw the structure of aldehyde or ketone produced when each of the alcohols is oxidized.

(i) $CH_3—CH_2—CH_2—CH_2—\underset{\displaystyle OH}{\underset{|}{CH_2}}$

(1 mark)

(ii) $CH_3—\underset{\displaystyle OH}{\underset{|}{CH}}—CH_2—CH_2—CH_3$

(1 mark)

(iii) $CH_3—CH_2—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2—\underset{\displaystyle OH}{\underset{|}{CH_2}}$

(1 mark)

(iv) $CH_3—\underset{\displaystyle OH}{\underset{|}{CH}}—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2—CH_3$

(1 mark)

(c) Draw the structure of the missing substance or substances in each if the following reactions involving amines and amine salts.

(i) $CH_3—NH_2 + ? \longrightarrow CH_3—\overset{+}{N}H_3\ Cl^-$

(2 marks)

(ii) $? + HBr \longrightarrow CH_3—\underset{\underset{CH_3}{|}}{CH}—\overset{+}{\underset{\underset{CH_3}{|}}{N}}H—CH_3\ Br^-$

(2 marks)

(iii) $? + NaOH \longrightarrow CH_3—NH—CH_3 + NaCl + H_2O$

(2 marks)

(d) Which of the terms acidic hydrolysis, saponification, hydrogenation and oxidation apply to each of the following reaction changes? More than one term may apply in a given situation.

(i) Carbon-oxygen single bonds are broken.

(1 mark)

(ii) Glycerol is among the products.

(1 mark)

(iii) Fatty acid salts are among the products.

(1 mark)

(iv) Carbon-carbon double bonds are changed to carbon-carbon single bonds.

(1 mark)

(e) When 25.0 cm^3 of 2.00 mol dm^{-3} nitric acid is added to 25 cm^3 of 1.00 mol dm^{-3} sodium hydroxide solution, the temperature rises by 6.5°C.

(i) Write an equation for the reaction.

(1 mark)

(ii) Calculate the number of moles of each reagent and state which one is in excess.

(3 marks)

(iii) Calculate the enthalpy change of neutralization for this reaction

(3 marks)

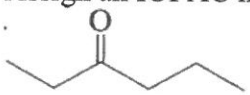
(TOTAL: 25 MARKS)

Question 3

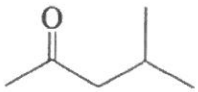
(a) Give the IUPAC names for the nine isomeric halogenated hydrocarbons that have the molecular formula $C_4H_8Cl_2$.

(9 marks)

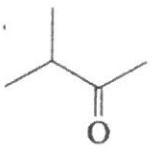
(b) Assign an IUPAC name to each of the following ketones.

(i) 

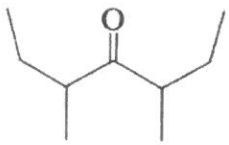
(1 mark)

(ii) 

(1 mark)

(iii) 

(1 mark)

(iv) 

(1 mark)

(c) Indicate whether each of the following statements applies to primary protein structure, secondary protein or tertiary protein structure. More than one type pf structure may apply in a given situation.

(i) Peptide linkages are present in the protein chain.

(1 mark)

(ii) Disulfide bonds between cysteine amino acids are present.

(1 mark)

(iii) Hydrogen bonds between C=O and N-H groups are present.

(1 mark)

(iv) The sequential order of amino acids in a protein chain is given.

(1 mark)

(d) Indicate whether each of the following statements concerning different types of enzyme inhibitors is true or false.

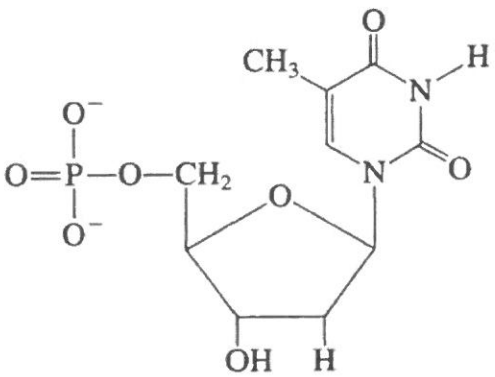
(i) A reversible competitive inhibitor temporarily blocks an enzyme's active site.
(1 mark)

(ii) A reversible noncompetitive inhibitor permanently changes the shape of an enzyme's active site.
(1 mark)

(iii) An irreversible inhibitor temporarily changes the shape of an enzyme's active site.
(1 mark)

(iv) Insecticides are examples of reversible noncompetitive inhibitors.
(1 mark)

(e) Consider the following nucleotide.



(i) What is the name of the nucleotide?
(1 mark)

(ii) Would this nucleotide be found in both DNA and RNA, only in DNA, or only in RNA?
(1 mark)

(iii) What is the name for the type of bond that connects the phosphate and sugar subunits?
(1 mark)

(iv) What is the name for the type of bond that connects the sugar and base subunits?
(1 mark)

(TOTAL: 25 MARKS)

Question 4

(a) For each of the following molecules, indicate whether or not cis-trans isomerism is possible.

(i) 2-methyl-1-pentene

(1 mark)

(ii) 1-hexene

(1 mark)

(iii) methylcyclohexane

(1 mark)

(iv) 4,5 – diethyloct-4-ene

(1 mark)

(b) Based on Markovnikov's rule, indicate whether hydration of each of the following alkenes produces one or two products.

(i) 2-butene

(1 mark)

(ii) 2-pentene

(1 mark)

(iii) cyclobutene

(1 mark)

(c) Draw the structural formula of the hemiacetal formed from each of the following pairs of reactants.

(i) Acetaldehyde and methanol

(2 marks)

(ii) 2-pentanone and ethyl alcohol

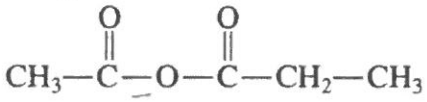
(2 marks)

(iii) Butanal and isopropyl alcohol

(2 marks)

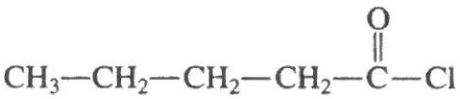
(d) Assign an IUPAC name to each of the following compounds.

(i)



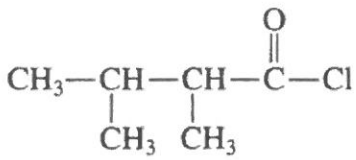
(1 mark)

(ii)



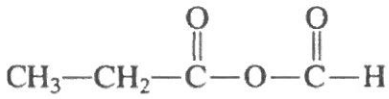
(1 mark)

(iii)



(1 mark)

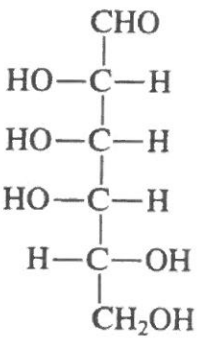
(iv)



(1 mark)

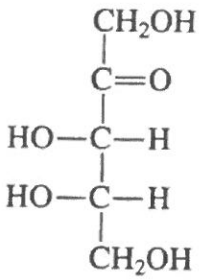
(e) Classify each of the following monosaccharides as an aldose or a ketose.

(i)



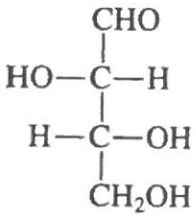
(1 mark)

(ii)



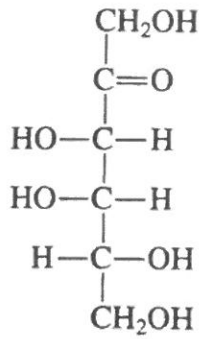
(1 mark)

(iii)



(1 mark)

(iv)



(1 mark)

(f) State the four types of attractive forces that give rise to tertiary protein structure.

(4 marks)

(TOTAL: 25 MARKS)

Question 5

(a) Draw a condensed structural formula for each of the following unsaturated hydrocarbons.

(i) 4-methyl-1-hexene

(2 marks)

(ii) 4-methylcyclohexene

(2 marks)

(iii) 1,3-pentadiene

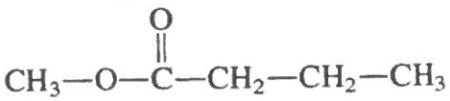
(2 marks)

(iv) 2-ethyl-1,4-pentadiene

(2 marks)

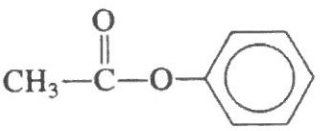
(b) For each of the following esters, draw the structural formula of the "parent" acid and the "parent" alcohol.

(i)



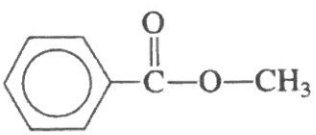
(2 marks)

(ii)



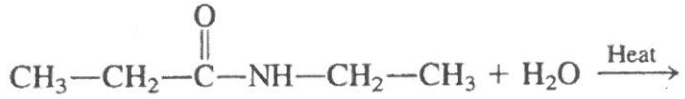
(2 marks)

(iii)

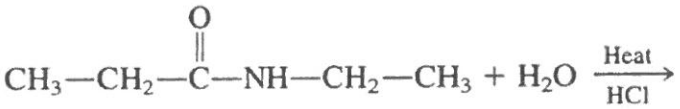


(2 marks)

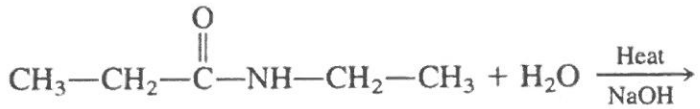
(c) Draw the structures of the organic products b each of the following hydrolysis reactions.

(i) 

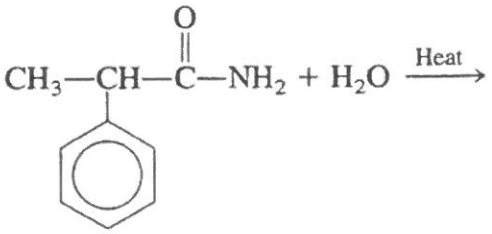
(1 mark)

(ii) 

(1 mark)

(iii) 

(1 mark)

(iv) 

(1 mark)

(d) Is the following monosaccharides a reducing sugar?

(i) D-glucose

(1 mark)

(ii) D-galactose

(1 mark)

(e) 3.53 g of sodium hydrogencarbonate was added to 30.0 cm^3 of 2.0 mol dm^{-3} hydrochloric acid. The temperature fell by 10.3 K. Work out which reagent was in excess and then calculate the enthalpy change for the reaction. Assume that the density of the solution is 1.00 g cm^{-3}, the specific heat capacity of the solution is 4.18 J g^{-1} K^{-1}.

$NaHCO_3$ (s) + HCl (aq) → NaCl (aq) + H_2O (l) + CO_2 (g)

(5 marks)

(TOTAL: 25 MARKS)

--THE END--

CHM1204(F)/AUG2019/S.T.LIM