FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**August 2021**
Programme	:	Foundation in Science (CFSI)
Course	:	**CHM1204: Chemistry 2**
Date of Examination	:	8 December 2021 (Wednesday)
Time	:	9:00am – 11:30am Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL** questions.
All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Periodic Table

Examiner(s)	:	**Ms. Lim Sze Theng**
Chief Moderator	:	Ms. Mazlita Yahya

*This paper consists of **8** printed pages, including the cover page.*

FOUNDATION IN SCIENCE (CFSI)
CHM1204: CHEMISTRY 2
FINAL ALTERNATIVE ASSESSMENT: AUGUST 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL FOUR (4)** questions. All questions carry equal marks.

Question 1

(a) The enthalpy of combustion of propan-1-ol, $CH_3CH_2CH_2OH$ (l), is -2020 kJ mol^{-1}. 0.600 g of propan-1-ol is burnt and used to heat 200 g of water in a calorimeter. The starting temperature of the water is 20.3°C.

(i) How much heat is released when 0.600 g of propan-1-ol is burned?

(2 marks)

(ii) Calculate the theoretical temperature of the water at the end of the experiment.

(3 marks)

(iii) Is the final temperature likely to be higher or lower than this theoretical answer? Explain your answer.

(2 marks)

(b) What is the total number of different chloroethanes (formula $C_2H_{6-n}Cl_n$, where n can be any integer from 1 to 6)? Draw all the possible different chloroethenes and name them.

(10 marks)

(c) Draw condensed structural formulas for the following branched alkanes.

(i) 5-Isobutyl-2,3-dimethylnonane

(2 marks)

(ii) 4-(1,1-Dimethylethyl)octane

(2 marks)

(d) What is wrong with each of the following attempts to name a cycloalkane using IUPAC rules?

(i) 3,4-Dimethylcyclohexane

(2 marks)

(ii) 2-Ethyl-1-methylcyclopentane

(2 marks)

(TOTAL: 25 MARKS)

Question 2

(a) (i) Draw the straight-chain formula of glucose and circle a carbon atom in the structure which is **not** chiral.

(2 marks)

(ii) Describe the structural difference between α-glucose and β-glucose.

(2 marks)

(b) Give the names of the monosaccharides which condense to form

(i) sucrose;

(2 mark)

(ii) starch.

(1 mark)

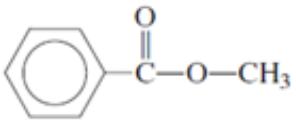
(c) State **one** major function of a polysaccharide in the body.

(1 mark)

(d) List three different sets of alkyl chloride–secondary amine reactants that could be used to prepare the tertiary amine ethylmethylpropylamine.

(6 marks)

(e) (i) Draw the structural formula of the "parent" acid and the "parent" alcohol of the following ester.

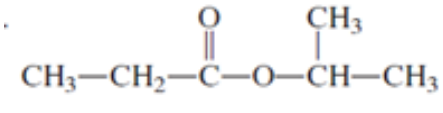


(2 marks)

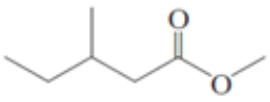
(ii) What are lactones and by what chemical reaction are they produced?

(2 marks)

(iii) Assign an IUPAC name to each of the following esters.



A



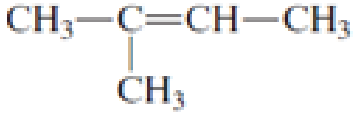
B

(2 marks)

(f) (i) The name 1,2-Dimethyl-4-cyclohexene is *incorrect* by IUPAC rules. Determine the correct IUPAC name for this compound.

(2 marks)

(ii) For each molecule, tell whether *cis–trans* isomers exist. If they do, draw the two isomers and label them as *cis* and *trans.*



I

II 3-hexene

(3 marks)

(TOTAL: 25 MARKS)

Question 3

(a) How many different tripeptides can be formed using three α-amino acids, glycine, alanine and valine, if each amino acid is used only once in each tripeptide?

(1 mark)

(b) (i) Name **two** methods by which an unknown tripeptide can be analysed.

(2 marks)

(ii) For **one** of these methods outline the experimental procedure and give the information which would be needed to identify the individual amino acids.

(4 marks)

(c) Alanine, $H_2N—CH(CH_3)—COOH$, has an isoelectric point of 6.0. Write the structural formulas of alanine at pH values **4.5, 6.0 and 7.5**.

(3 marks)

(d) The hydrocarbons **T**, C_4H_{10}, and **U**, C_4H_8, are both unbranched.

T does **not** decolourise bromine.
U decolourises bromine and shows geometrical isomerism.

(i) Draw the skeletal formula of **T**.

(1 mark)

(ii) The hydrocarbon **T**, C_4H_{10}, has a branched isomer.
Suggest why unbranched **T** has a higher boiling point than its branched isomer.

(2 marks)

(iii) Give the structural formula of **U**.

(1 mark)

(iv) Explain why **U** shows geometrical isomerism.

(2 marks)

(e) The alcohols **V** and **W** are isomers of each other with molecular formula $C_4H_{10}O$. Both isomers are branched.

When **V** is heated under reflux with acidified potassium dichromate(VI) no colour change is observed.

When **W** is heated under reflux with acidified potassium dichromate(VI) the colour of the mixture changes from orange to green and **X**, $C_4H_8O_2$, is produced.

Identify **V**, **W** and **X**.

(3 marks)

(f) The isomers **Y** and **Z**, $C_5H_{10}O$, both are carbonyl compounds

Y is unbranched and reacts with alkaline aqueous iodine to produce a yellow precipitate.

Z does not react with alkaline aqueous iodine. It contains a chiral centre and produces a silver mirror when warmed with Tollens' reagent.

(i) Name the yellow precipitate produced by the reaction between **Y** and alkaline aqueous iodine.

(1 mark)

(ii) Give the structural formula of **Y** and of **Z**.

(2 marks)

(iii) Explain the meaning of the term *chiral centre*.

(1 mark)

(g) Draw the structural formula of the hemiacetal formed from 2-pentanone and methanol

(2 marks)

(TOTAL: 25 MARKS)

Question 4

(a) Describe and explain the way in which the activity of an enzyme is influenced by an increase in

(i) substrate concentration;

(3 marks)

(ii) temperature.

Labelled graphs, instead of descriptions, may be used to support your answer.

(4 marks)

(b) Nucleic acids are made up of units called *nucleotides*. A nucleotide is composed of a phosphate group, a pentose sugar and a nitrogen-containing base.

(i) State the **two** main differences between the chemical composition of RNA and DNA.

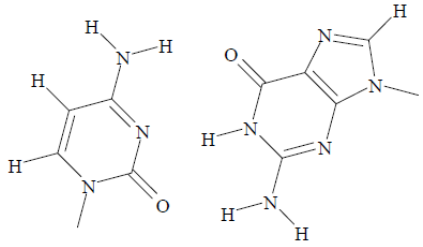
(2 marks)

(ii) What type of chemical reaction takes place when nucleotides combine to form nucleic acids?

(1 mark)

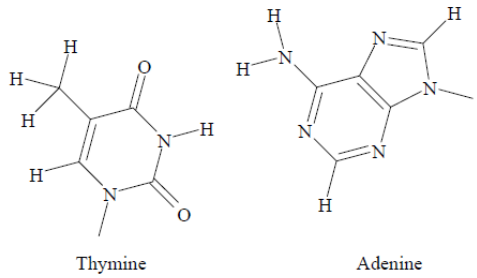
(iii) DNA consists of two helical strands of nucleotides bonded together. The diagrams below show which base pairs bond to each other. State what kind of bond holds the two strands of DNA together and show these bonds on each diagram. State which other **two** molecules are bonded to a base to form a *nucleotide* and describe how individual nucleotides are joined to form a single strand of DNA.

Cytosine pairs with guanine



Cytosine Guanine

Thymine pairs with adenine



Thymine Adenine

(6 marks)

(c) Ester are compounds which provide the perfumes of many flower and the flavour of many fruits.

The ester $CH_3(CH_2)_2CO_2CH_3$ contributes to the aroma of apples.

(i) State the reagents and conditions needed for the hydrolysis of this ester.

(1 mark)

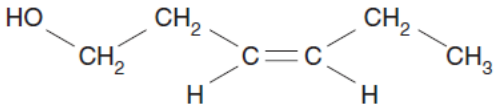
(ii) Write the equation for the hydrolysis of this ester.

(1 mark)

(iii) Apart from their use as perfumes and food flavourings, state **one** major commercial use of esters.

(1 mark)

(d) Leaf alcohol is a stereoisomer that can form when insects such as caterpillars eat green leaves.



(i) Draw the other stereo-isomer of leaf alcohol.

(1 mark)

(ii) Draw the structure for the ester formed when leaf alcohol reacts with ethanoic acid. Show **all** the bonds in the ester group.

(2 marks)

(iii) Deduce the relative molecular mass, *M*r, for leaf alcohol.

(1 mark)

(iv) Leaf alcohol was reacted to form a product with an *M*r value 18 units less. Suggest a structure for this product and deduce the type of reaction that took place.

(2 marks)

(TOTAL: 25 MARKS)

--THE END--

CHM1204(F)/AUG2021/S.T.LIM