CHEMISTRY THEORY

Date: .. 22 / 06... /2022
Period:.... 8H30-11H30...

END OF TERM III EXAMINATIONS

GRADE / LEVEL: **S5**
OPTION / Advanced **level**

DURATION: **3 HOURS**

MARKS: **..... /100.....**

INSTRUCTIONS

1. There are 2 sections in this paper:

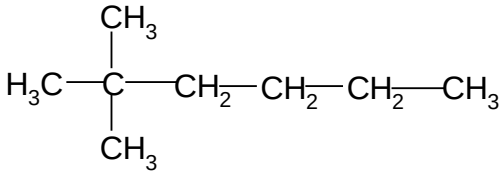
   Section A (70 marks): Attempt all questions in this section

   Section B (30 marks): Attempt all questions in this section.

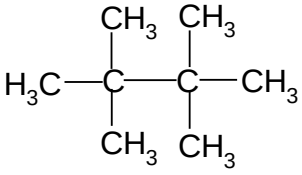
2. Do not use periodic tables
3. Non-programmable calculators may be used
4. Answers should be written on blank papers provided
5. Use a blue or black pen only

Section A: Attempt all the questions /70 Marks

1) The following compounds are present in petroleum. Name them using IUPAC **(4marks)**



A



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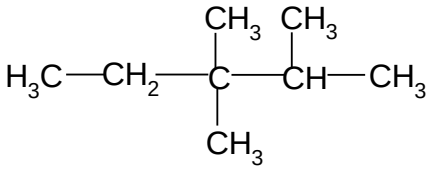

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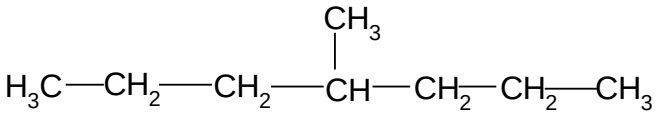


D

2. An alkene Y has the empirical formula CH_2 and a molecular mass of 56. (C=12;H=1: O=16)

Identify the molecular formula of the alkene Y. **(3marks)**

3. Butane, C_4H_{10}, is a hydrocarbon which is used as a fuel.

a) Explain what is meant by the term *hydrocarbon*. **(1mark)**

b) Write an equation for the complete combustion of butane. **(2marks)**

c) Under what conditions would you expect incomplete combustion to occur **(4marks)**

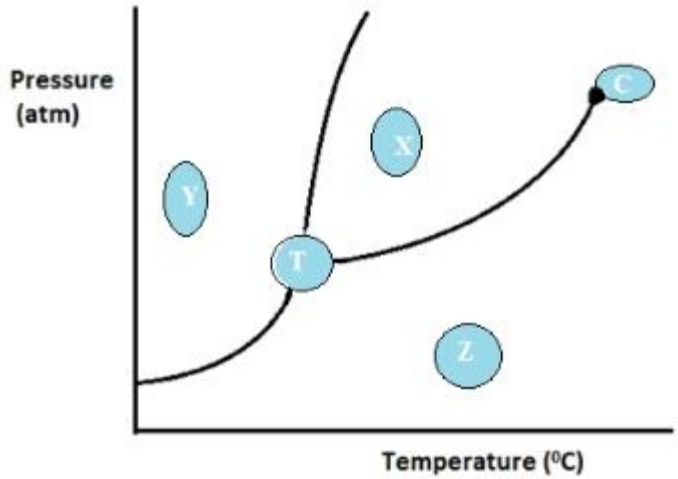
4. Compound **A** (M_r = 215.8) contains 22.24% carbon, 3.71% hydrogen and 74.05% bromine by mass.

a) Show that the molecular formula of **A** is $C_4H_8Br_2$. **(3marks)**

b) There are nine structural isomers of molecular formula $C_4H_8Br_2$, three of them have branched carbon chains. Give the names of any two of the branched chain isomers of $C_4H_8Br_2$. **(2 marks)**

5. Ethanol reacts with ethanoic acid to produce an ester and water.
   a) Write down the balanced chemical equation. (**2marks**)
   b) How do you call such a reaction? (**1mark)**
   c) 5.5g of ethyl ethanoate are produced from 4.0g of ethanol and 4.5g of ethanoic acid. Calculate the percentage yield of ethyl ethanoate. (**4marks**)

6. The diagram below shows different states of a substance at different temperatures and pressure.



   a. Give the state of matter in the parts labelled X, Y, Z, and T respectively? **(2marks)**
   b. Explain what will happen to X if the pressure is much lowered at constant temperature. **(1mark)**

7. The following tests were carried out on some unknown organic compounds A,B,C and D .

a) Compound A was shaken with bromine in tetrachloromethane (carbon tetrachloride). There was an immediate decolourization of the red bromine solution.

b) Compound B was shaken in tetrachloromethane (carbon tetrachloride). There was only a very slow decolourization of the red bromine solution, and after a white pungent acid fumes could be detected.

c) A small piece of freshly cut sodium was added to the non-acidic solution compound C. A gas was liberated, which forms an explosive mixture with air.

d) On warming, compound D with ethanol and a few drops of concentrated sulphuric acid, a pleasant fruity smell could be detected when the mixture was poured into water.

Assign the following formulas to compounds A,B,C and D : **(4marks)**

i. $CH_3CH_2CH_2OH$

ii. $CH_3CH_2CH_2CH_2CH_2CH_3$

iii. $CH_3CH_2CH_2COOH$

iv. $CH_2 =CHCH_2CH_3$

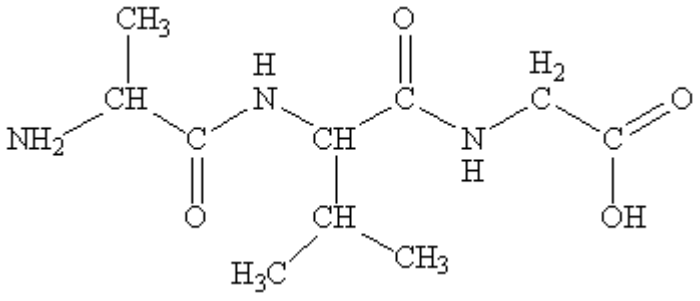
8. The carbonyl compounds CH_3COCH_3 and CH_3CH_2CHO are structural isomers.

a. Name these compounds. (**2marks)**

b. State the reagents you would use and the observations you would make using chemical test in which the two compounds give similar results. (**2marks)**

c. State the reagents you would use and the observations you would make using chemical test in which the two compounds give different results. (**2marks)**

9. The structure of a certain tripeptide is shown here:



a.

i. Draw the displayed formulae of the three amino acids that make up the tripeptide. **(3marks)**

ii. Which of these amino acids does not have a chiral carbon atom? **(1mark)**

b. This tripeptide can be split up into the three amino acids by refluxing with aqueous hydrochloric acid.

i. Which bond is broken in this reaction? **(1mark)**

ii. The reaction can be described as hydrolysis. Give reason **(2marks)**

10. Organic acid A has the formula $(CH_2)_n(COOH)_2$ and reacts with dilute NaOH according to the following chemical equation:

$(CH_2)_n(COOH)_2 + 2NaOH \rightarrow (CH_2)_n(COONa)_2 + 2H_2O$.

The mass of 2.0g of organic acid A is dissolved in water and the solution is made up to $250cm^3$ .This organic acid is filled in a burette and $18.40cm^3$ of $(CH_2)_n(COOH)_2$ is required to neutralize $25cm^3$ of $0.1mol.dm^{-3}$ NaOH solution.

a. Calculate the number of moles of NaOH in $25cm^3$ solution.**(1mark)**

b. Determine the number of moles of $(CH_2)_n(COOH)_2$ that reacted with $25cm^3$ of $0.1mol.dm^{-3}$ NaOH solution.**(2marks)**

c. Calculate the number of moles of $(CH_2)_n(COOH)_2$ present in $250cm^3$solution.**(1mark)**

d. Deduce the molecular mass of $(CH_2)_n(COOH)_2$ acid.**(1mark)**

e. Find the value of n (C=12, O=16 H=1) **(2marks)**

11. The equivalent conductance at infinite dilution (Λ_0) of HCl, CH_3COONa and NaCl are 426.16; 91.0 and 126.45ohm^{-1} cm^2g equ^{-1} respectively. Calculate Λ_0 of acetic acid. **(3marks)**

12. An unknown metal M is plated. It took 74.1s for a current of 2.00 A to plate out 0.107 g of the metal from a solution containing $M(NO_3)_3$.

a. Write the reduction reaction. **(2marks)**

b. Calculate the quantity of electricity. **(4marks)**

c. Deduce the molar mass of the metal M. **(1mark)**

13. Methane can be reacted with steam to produce carbon monoxide and hydrogen. The equation for this process is given below.

$$CH_4(g) + H_2O(g) \longrightarrow CO(g) + 3H_2(g)$$

The table below shows the enthalpy changes of formation for methane, steam and carbon monoxide.

compound	H_f / kJ mol^{-1}
CH_4	–75
H_2O	–242
CO	–110

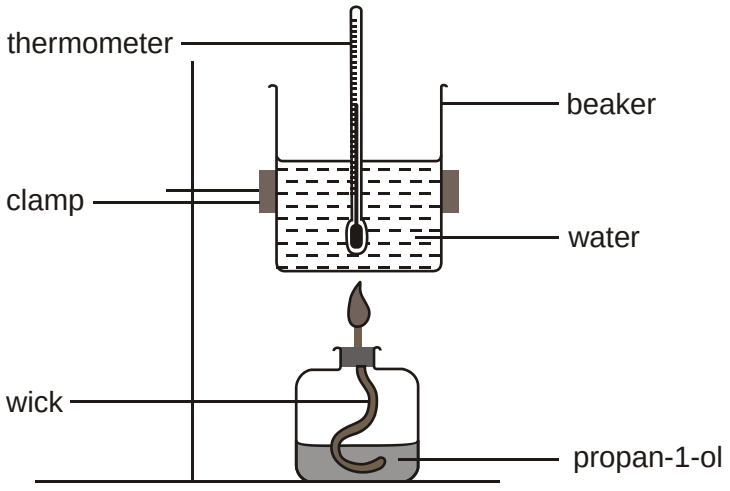
(a) Define the term *enthalpy change of formation.* **(2marks)**

(b) Write the equation, including state symbols, representing the enthalpy change of formation for methane, CH_4. **(2marks)**

(c) Use the ΔH_f values in the table to calculate the enthalpy change for the reaction shown in the equation shown above. **(2marks)**

Section B: Attempt all questions /30 marks

14. In an experiment to determine the standard enthalpy change of combustion of propan-1-ol, C_3H_7OH, a student used the apparatus shown below. **/10 marks**



(a) Define the term *enthalpy change of combustion.* **/2marks**

(b) Write the equation for the standard enthalpy change of combustion of propan-1-ol, C_3H_7OH. **/1marks**

(c) The student measured 50.0 cm^3 of water into the beaker and lit the burner. When the temperature of the water had gone up by 12.8°C, he found that 0.100 g of propan-1-ol had been burnt. **/5marks**

(i) Calculate the energy, in kJ, produced by burning 0.100 g of propan-1-ol. The specific heat capacity of water is 4.18 J g^{-1} K^{-1}.

(ii) Calculate the number of moles of propan-1-ol in 0.100 g.

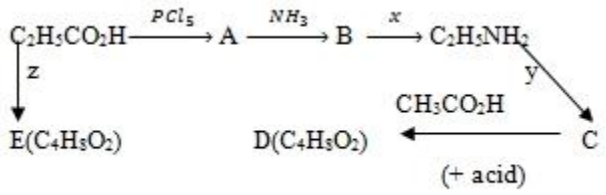
(iii)Calculate the enthalpy change of combustion, in kJ mol^{-1}, of propan-1-ol.

(d) The student looked in a text book and found that the actual value for the standard enthalpy change of combustion of propan-1-ol was more exothermic than the experimental value.

Suggest **two** reasons for the difference between this value and the one he obtained experimentally. /**2marks**

15. /10 marks

a. Identify compounds A, B, C, D and E, and reagents x, y and z in the following scheme of reactions. Write equations for the reactions involved:



b. Name A and B.

16.

(a) Explain why ethylamine is a stronger base than ammonia. **(3marks)**

(b) Give a suitable reagent or combination of reagents for the formation of ethylamine from ethane nitrile and write an equation for the conversion: **(2marks)**

(c) Name and outline a mechanism for the reaction between ethylamine and ethanoyl chloride. **(5marks)**

S5 CHEMISTRY MARKING SCHEME

Section A: Attempt all the equations

1. Nomenclature **(4marks)**
   Formula

   A. $(CH_3)_3CCH_2-CH_2-CH_3$ 2,2-dimethylhexane

   B. $(CH_3)_3C-C(CH_3)_3$ 2,2,3,3-tetramethylbutane

   C. $CH_3-CH_2-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH(CH_3)_2$ 2,3,3,trimethylpentane

   D. $CH_3-CH_2-CH_2-\underset{\displaystyle CH_3}{\overset{|}{CH}}-CH_2-CH_2-CH_3$ 4-methylheptane

2. An alkene Y has the empirical formula CH_2

   a) Its molecular formula in $(CH_2)n$ **(3marks)**

   n is such as$(12+2)n = 56.0$ or $n=56:14=4$

   Y has the molecular formula $(CH_2)_4$ i.e C_4H_8

3. Butane C_4H_{10} is a hydrocarbon which is used as a fuel

   a) A hydrocarbon is a molecule made up of carbon atoms and hydrogen atoms only **(1mark)**

   b) Complete combustion of butane

   $C_4H_{10}(g) + 13/2\ O_2(g) \longrightarrow 4CO_2(g)+5H_2O(l)$ **(2 marks)**

   c) I should expect incomplete combustion to occur if **(4 marks)**

   There is limited

   There is low temperature

There is insufficient oxygen (or shortage of oxygen)

There is poor mixing

4. Compound A (M=215.8) is such as

A	C	H	Br
100g	22.4g	3.71g	74.05g
	22.4/12	3.71/1	74.05/79.9 **(1 mark)**
	1.367	3.75	0.927
	2	4	1

The empirical formula is C_2H_4Br **(1mark)**

The molecular is $(C_2H_4Br)n$; n being such as

(12x2+4+79.9)n =215.8 i.e 107.9 n=215.8 or n = 2)

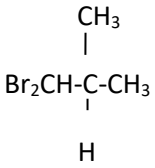
The molecular formula of A is $C_4H_8Br_2$ **(1mark)**

It is possible to calculate using the following table

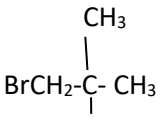
A	C	H	Br
100g	22.4g	3.71g	74.5g **(1 mark)**
215.8g	?	?	?
215.8g	48.3392g	8.00618g	159.7991g **(1 mark)**
1 mol	48.3392/12mol	8.00618/1 mol	15.8/79.9mol
1 mol	4mol	8mol	2mol **(1 mark)**

There are mine structural isomers of molecular formula $C_2H_4Br_2$

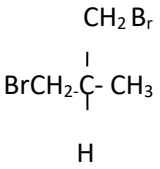
Three of which have branched carbon chains.



1,1-Dibromomethylpropane **(1 marks)**



1,2- Dibromomethylpropane **(2 marks)**



1,3- Dibromomethylpropane **(1 mark)**

Give two marks

5. esterification reaction (**2marks**)

a) $CH_3CH_2OH + CH_3COOH \longrightarrow CH_2COOCH_2CH_3 + H_2O$

$C_2H_5OH + CH_3COOH \longrightarrow CH_3COOC_2H_5 + H_2O$

b) This is on esterification reaction (**1mark**)

c) when EtOH and AcH react here, they do it in 1:1 mole ratio i.e

EtOH	Acid	Ester	H_2O	
1mol	1mol	1mol	1mol	**(0.5mark)**
4.6g	60g	98g	18g	**(0.5mark)**
4.0g	?	?	?	
?	4.5g	?	?	
4.g	5.22g	8.52g	1.57g	**(1 mark)**
3.45g	4.5g	7.35g	1.35g	**(1 mark)**

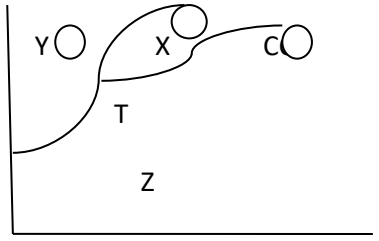
When 4.0g of EtOH reacted with 4.5g of AcH ,they produce 7.35g of AcEt; not add they produce 5.5g, i.e the yield is

$\frac{5.5}{7.35} \times 100\% = 74.85\%$ **(1 mark)**

The effective yield is 5.5g

The theoretical yield is 7.35g

6. Given such a place diagram **(4marks)**



X: is liquid (0.5mark

Y :is solid

Z: is gas

T: is triple point

C: critical point

b) The substance at X would evaporate if the pressure was lowered at constant pressure.

7. Organic compounds	Formula	Observations
A	CH_2= CH CH_2CH_3	iv)
B	CH_3 $(CH_2)_4$ CH_3	ii)
C	CH_3CH_2 CH_2OH	i)
D	CH_2 CH_2 CH_2COOH	iii)

8. CH_3CO CH_3 and CH_3 CH_2CHO are structural isomers;

a. Propanone Propanal respectively.They have both a carbonyl group **(2marks)**

b. Adding 2,4 diphenyl hydrazine D.N.P.H. A Braddy reagent gives a yellow or orange precipitate

c. Tollens' reagent on aldehyde makes a silver mirror. ketones do not react with Tollen's reagent

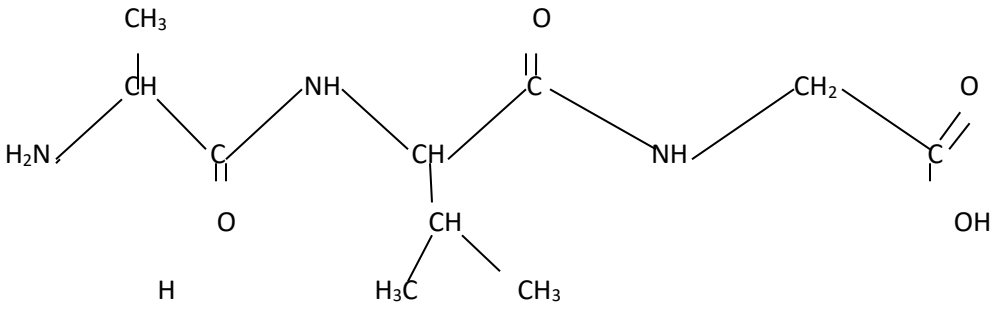
	CH_3CO CH_3	CH_2 CH_2CHO
Braddy's reagent	yellow precipitate	Yellow precipitate **(2marks)**

Tollen's reagent no change Silver mirror **(2marks)**

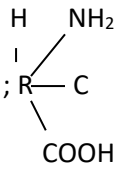
9.

Aminoacids

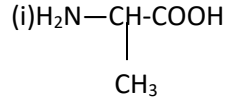
Given the tripeptide



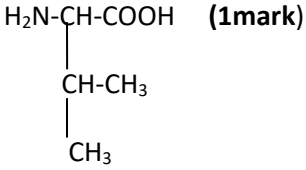
It is made of 3 aminoacides ;



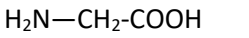
a. (i)



(1mark)

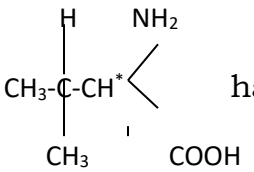


(1mark)

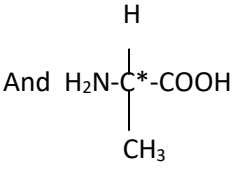


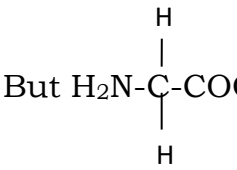
(1mark)

(ii)



has an asymetric carbon atom



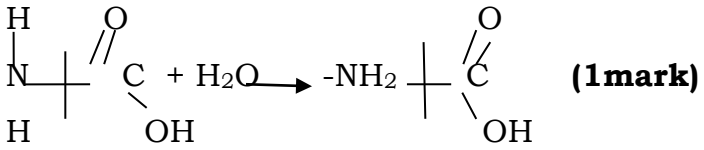


But has no chiral carbon atom **(1mark)**

b. Aminoacids formed by hydrolyzing of the tripeptide

(i) -C(=O)-NH— (or peptide) bonds are broken **(1mark)**

(ii) It is an acid hydrolysis :



(1mark)

10. An organic acid A with the general formula $(CH_2)_n(COOH)_2$ reacted with NaOH;

$HOOC(CH_2)_nCOOH + 2\ NaOH \rightarrow NaOOC(CH_2)_nCOONa + H_2O$

a. $2.5cm^3$ of .1M NaOH or

$25xo.1x10^{-3} = 25x10^{-4}$ mol NaOH **(1 mark)**

b. As acid and NaOH reacted in the mol ratio 1:2 **(1mark)**

$25x10^{-4}$ mol NaOH reacted with

$\frac{1}{2} \times 25x10^{-4}$ mol $HOOC(CH_2)_n COOH$ i,e **(1 mark)**

$12.5x10^{-4}$ mol $HOOC(CH_2)_n COOH$ **(1mark)**

c. $18.40cm^3$ contain $12.5x10^{-4}$ mol of acid

$250cm^3$ contain: $\frac{12.5x10^{-4} \times 250}{18.40} = 169.837x10^{-3}$ mol (**1 mark)**

d. The $169.837x5x10^{-4}$ mol has 2.0g

1 mol $\longrightarrow$ $(2g/169.837)x10^4$

Thus the molar mass of the acid $HOOC(CH_2)_n COOH$ is $(1+16x2)2+ 14n= 117.56$

(1mark)

$66+14n= 117.56 \Leftrightarrow n=4$ **(1mark)**

A is $HOOC(CH_2)_4 COOH$

11. The equivalent conductance at infinite dilution of HCl ,CH_3COONa and NaCl are respectively

426.1, 91.0 and 126 ohm^{-1} . cm^2 equivalent.

As CH_3COONa + HCl $\longrightarrow$ CH_3COOH + NaCl

The equivalent conductance at infinite dilution of CH_3COOH is such as

$\wedge_0 HCl + \wedge_0 CH3COONa = \wedge_0 CH_3COOH + \wedge_0 NaCl$ **(1 mark)**

And $\wedge_0 CH_3COOH$ is 426.16+91.0 – 126=391.16 **(2marks)**

12. M deposits as follows ,$M(NO_3)_3 \longrightarrow 3NO_3^- + M^{3+}$

$M^{3+}(aq) + 3e^- \longrightarrow M(s)$ (*) **(2marks)**

The quantity of electricity is

Q= I x t = 2.00Ax74.15= 148.3c **(2marks)**

According to (*)

3 moles deposit 1 mol

3x965C $\longrightarrow$ 1 mol M **(2 marks)**

148.3C $\longrightarrow$ $\frac{1 \text{ mol} \times 148.3}{3 \times 96500} = 5123 \times 10^{-6}$ mol

If 0.107g=768.4×10^{-6} mol

1mol $\longrightarrow$ $0.107/5123 \times 10^{-6}$ g= 139.201g **(1 mark)**

M is trivalent metal with A=209

13. Reaction to produce H_2

$CH_4(g) + H_2O(g) \longrightarrow 3\ H_2(g) + CO(g)$

a) The enthalpy change of formation is the standard reaction enthalpy for the formation of the compounds from its elements in their **(2marks)** Most stable reference states at the chosen temperature and pressure Thus we write for CH_4

b) $C(s) + 2H_{2(g)} \longrightarrow CH_4(g)$ **(2marks)**

For $CH_4(g) + H_2O(g) \longrightarrow 3\ H_2(g) + CO(g)$

The enthalpy change Is**(2marks)**

$\Delta H = \Sigma H_{f\ products} - \Sigma H_{f\ reagents}$

$\Delta H = (-110) - (-242 - 75) = -110 + 317 = +207 Kj/mol$

Section B: Attempt all questions /30 marks

14.

(a) The *enthalpy change of combustion* is the enthalpy change when 1 mole of substance/ element/ compound (**1mark)** is completely burnt (**1mark**)

(b)The equation for the standard enthalpy change of combustion of propan-1-ol, C_3H_7OH is

$C_3H_7OH(l) + 4½\ O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(I)$

correctly balanced equation (**0.5mark**)

state symbols (species must be correct) (**0.5mark**)

(c)The student measured 50.0 cm^3 of water into the beaker and lit the burner.When the temperature of the water had gone up by 12.8 □C, he found that 0.100 g of propan-1-ol had been burnt.y burning 0.100 g of propan-1-ol,

(i) the energy produced is $Q = mc\ \Delta T$ (**1mark**)

$Q = 50 \times 4.18 \times 12.8 = 2675\ (J) = 2.68\ (kJ)$ (**1mark**)

ignore the sign

(ii)Mr propan-1-ol = 60 (**1mark**), and the number of moles of propan-1-ol in 0.100 g is:

number moles = 0.100 :60=0.00167 (**1mark**)

iii) the enthalpy change of combustion, of propan-1-ol is

ΔH = -2.68 (kJ) : 0.00167 =- $\tilde{}$(1608($KJ\,mo\tilde{l}^{1}$) (**1mark**) ignore the sign

The student looked in a text book and found that the actual value for the standard enthalpy change of combustion of propan-1-ol was more exothermic than the experimental value. . Plausible reasons for the difference between this value and the one he obtained experimentally may be: **/2marks**

heat losses (**1mark**)thermal capacity of beaker ignored

(**1mark**)conditions were non-standard(**1mark**)combustion

could be incomplete (**1mark**)propan-1-ol evaporates

(**1mark**)water evaporates (**1mark**)

Give two marks

15.

Answer

a)

A: CH_3CH_2COCl, **B**:$CH_3CH_2CONH_2$, **C**:CH_3CH_2OH, **D**:$CH_3CH_2COOCH_3$, **E**:$CH_3CH_2COOCH_3$, **X**:$NAOH/Br_2$ or NAOBr, **Y**:HNO_2 or $NaNO_2/HCl$, **Z**:CH_3OH

b) **A:** CH_3CH_2COCl: Propanoyl chloride.

B:$CH_3CH_2CONH_2$: Propanamide

Accept any other correct answer

16.

(a) Lone pair on N <u>or</u> electron density on N **(1Mrk)**

more available <u>or</u> electron density increased (**1Mrk)**

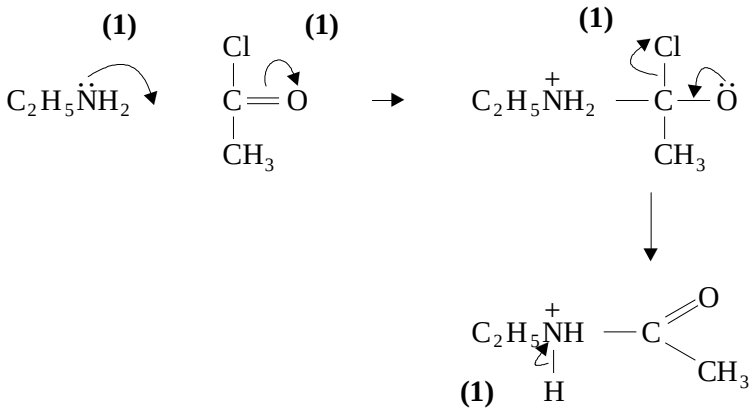
electron donation <u>or</u> inductive effect (**1Mrk)**

(b) *Reagent(s)* $LiAlH_4$ or Na/EtOH or H_2/Ni (**1Mrk)**

Equation $CH_3CN + 4[H]$ or $2H_2 \longrightarrow CH_3CH_2NH_2$ **(1Mrk)**

(c) *Name of mechanism*: addition-elimination (**5Mrks)**

Mechanism



CHEMISTRY PRACTICAL EXAM

Date: ... 28 / 06... /2022
Period:.. 8H30-10H00...

END OF TERM III EXAMINATIONS

GRADE / LEVEL: **S5**
OPTION / Advanced **level**

DURATION: **1 HOUR 30 minute**

MARKS: **..... /20.....**

INSTRUCTIONS

1. Please read carefully before you start and make sure that you have all the apparatus and chemicals that you may need.
2. This paper has one question.
3. Answer the questions in this paper and record your answers in the spaces provided. If necessary ask for a paper.

Chemistry lab

A. You are provided with the followings:

a. FA1which is a solution of HOOC-COOH x H_2O prepared by dissolving 2.75g of hydrated oxalic acid in distilled water to make 250.0cm^3 of solution.

b. BA, a 0.01M sodium hydroxide (NaOH)solution.

c. Phenolphthalein indicator solution

B. Procedure

a. Pipette 10.0$cm^3$of FA1 into a conical flask and add 2 drops of phenolphthalein indicator.

b. Titrate the resultant solution by 0.01M sodium hydroxide solution from the burette.

c. Record your results in the table below. **(4.5marks**)

The pipette of the volume used is ……**(0.5mark)**

Experiment n^o	1	2	3
Final burette readings (cm^3)			
Initial al burette readings(cm^3)			
Volume of BA used			

The average volume of 0.01M NaOH used is ……**cm^3**.

I. The balanced chemical equation for the present reaction is

……

……**(2marks)**

II. The number of moles of sodium hydroxide present in 20.25cm^3 is

……

…… **(2marks)**

I. The mole ratio (HOOC-COOH): NaOH is

.....**(1mark)**

II. The number of mole of pure oxalic acid (HOOC-COOH) present in the 10 cm^3 aliquot is

.....

..... **(2marks)**

III. The number of mole of pure oxalic acid (HOOC-COOH) present in the 250 $cm^3$is

.....

.....**(2marks)**

IV. The total mass of pure oxalic acid present in the sample is

.....

..... **(2marks)**

V. The mass of water present in the sample is

.....

.....**(2marks)**

VI. Finally, the value of x is

.....

.....**(2marks)**

MARKING SCHEME CHEMISTRY -Practical, S5:

PRACTICAL (experiment) 2022

-Use the teacher's results of the experiment as a reference to mark calculations as well as drawing conclusions of the students work.

-If the results of the students show a wide difference from the teacher's results, deduct a half of the marks to be awarded.

-If the method of calculations is correct, give the student all the marks on the calculation regardless of the discrepancy error of volumes obtained in the titration.

-For the calculations, see Marking Scheme of Alternative to practical question paper.

CHEMISTY ALTERNATIVE TO PRACTICAL EXAM

Date: ... 28 / 06... /2022
Period:.. 8H30-10H00...

END OF TERM III EXAMINATIONS

GRADE / LEVEL: **S5**
OPTION / Advanced **level**

DURATION: **1 HOUR 30 minute**

MARKS: **..... /20.....**

INSTRUCTIONS

1. Please read carefully before you start answering.
2. This paper has ONE question. **(15 marks)**
3. Answer the questions in your answer booklet.

To calculate the water of crystallization x in HOOC-COOH.xH_2O

2.75 g of hydrated oxalic acid HOOC-COOH.xH_2O are dissolved in 100cm^3 of distilled water. The above solution is adjusted to 250 cm^3 (using distilled water). 10 cm^3 of this parent -solution reacted with a 0.01M solution of sodium hydroxide. The average of volume of sodium hydroxide required for complete reaction is 20.25cm^3.

I. Write down the balanced chemical equation for the present reaction. **(2marks)**

II. Which type of reaction is concerned here? (**2marks)**

III. Why do they write "average "volume? (**2marks)**

IV. How many moles of sodium hydroxide are in 20.25cm^3? (**2marks)**

V. Calculate the number of mole of pure oxalic acid (HOOC-COOH) present in the 10 cm^3 aliquot. (**3marks)**

VI. Deduce the number of mole of pure oxalic acid (HOOC-COOH) present in the 250 cm^3. (**2marks)**

VII. Calculate the total mass of pure oxalic acid present in the sample. **(2marks)**

VIII. Then deduce the mass of water present in the sample (**2marks)**

IX. Finally calculate the value of x. (**3marks)**

X. What is a hydrated crystal?

S5 CHEMISTRY Marking-SCHEME-alternative to practical

(i) Key-reaction equation

$HOOC\text{-}COOH\ (aq)+2NaOH(aq) \rightarrow NaOOC\text{-}COONa(aq)+2H_2O(l)$

(ii) The present reaction is neutralization

(Iii) More than two trials are done to get a consistent value reading. The measure will be the average burette readings.

(iv) $20.25cm^3$ of 0.01M contain

$20.25x10^{-3}x0.01=20.25x10^{-5}$ mol of NaOH

(v) As HOOC-COOH and NaOH reacted in the mole ratio 2:1

2moles of NaOH reacted with 1 mole of HOOC-COOH

1 mole $\longrightarrow$ 0.5 mole of HOOC-COOH

$20.25x10^{-5}$ mole $\longrightarrow$ $0.5x20.25x10^{-5}$ mole HOOC-COOH

$20.25x10^{-5}$ mole $\longrightarrow$ $10.125x10^{-5}$ mole HOOC-COOH

(vi) $10cm^3$ aliquot contain $10.125x10^{-5}$ mole

$250\ cm^3 \longrightarrow \frac{10.125x10^{-5}x250}{10}$ mole

$250\ cm^3 \longrightarrow 0.0253125$ mole of pure acid

(vii) The molar mass of HOOC-COOH is

$(1+16x2+12)2g=9g/mol$

0.0253125 mole of pure HOOC-COOH is

$90x0.0253125\ g=2.27512g$

(viii) Thus the sample contains

$(2.75-2.27512)g=0.447187g$ of water

(ix) 2.27512g of pure HOOC-COOH link 0.47187g

90.0g $\longrightarrow$ $\frac{0.47187}{2.97512} x\ 90=18.667g$ of water

(x) Finally as 18g is the mass of 1 mole of water, 18.667g contains

$\frac{18.667}{18}$ = 1 mol of water

(xi) We write $HOOC\text{-}COOH, H_2O$

CONFIDENTIAL AND PRACTICAL EXAMINATION, 2022

S5 END OF YEAR EXAM, 2022

SUBJECT: CHEMISTRY PRACTICAL

ADVANCE INSTRUCTIONS

(A) CONFIDENTIAL

Great care should be taken that information given below does not reach the candidates either directly or indirectly.

Candidates are not allowed to use reference books during the examination.

(B) MANAGEMENT OF CHEMISTRY PRACTICAL

Section I:

The teacher must try the question and use his/her results as a reference to mark students work.

PRACTICAL CHEMISTRY EXAMINATION S5, 2022
CONFIDENTIAL

Chemicals

Prepare

- FA1which is a solution of HOOC-COOH x H_2O prepared by dissolving 2.75g of hydrated oxalic acid in distilled water to make 250.0cm^3 of solution.
- BA, a 0.01M sodium hydroxide (NaOH) solution.
- Phenolphthalein indicator solution

Material for titration

Each student will require:

APPARATUS/ CANDIDATE	**CHEMICALS/ CANDIDATE**
2 empty beakers in borosilicate (250 ml)	➢ 120 ml of solution of
1 pipette (25 ml)	➢ 150 ml of BA
1 dropper	Phenolphthalein indicator
3 labels to mark the beakers containing different solutions	
1 propipette to fix on the pipette (25 ml)	
1 filter funnel (transparent, plastic)	
1 retort stand	
1 burette (50 ml)	
3 conical flasks (250 ml)	