

REGISTRATION CENTRE NUMBER		CENTRE NAME	
CANDIDATE'S FULL NAMES			
CANDIDATE IDENTIFICATION NUMBER	SUBJECT CODE	PAPER NUMBER	FOLD HERE
	0715	2	
FOR OFFICIAL USE ONLY (Candidate Random CODE):			
CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD ADVANCED LEVEL EXAMINATION			
SUBJECT TITLE CHEMISTRY	SUBJECT CODE 0715	PAPER NUMBER 2	
EXAMINATION DATE: JUNE 2017			

Three hours

Enter the information required in the boxes of the flap.

Answer ALL the SIX questions in this booklet.

The mark allocation is indicated for each question. Each question carries 20 marks.

Verify that this booklet contains six questions, no questions are repeated and there are no blank pages.

Inform the invigilator in case this booklet contains less than six questions, questions are repeated or there are blank pages so that the booklet should be changed.

Blank spaces in this question booklet may be used for rough work.

In calculations you are advised to show all the steps in your working, giving your answer at each stage.

All necessary working must be shown. No marks will be awarded for answers without brief statements showing how the answers have been obtained.

Calculators may be used.

----- TURN OVER for USEFUL DATA -----

FOR EXAMINERS' USE ONLY

Marked by:..... Signature: Date: Checked by:..... Signature: Date:		<u>SCORE</u>
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SECTION A: PHYSICAL AND GENERAL CHEMISTRY

1. (a) What is
(i) a standard solution?

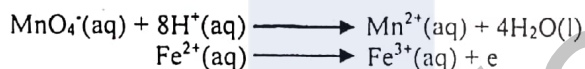
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- (ii) a reduction-oxidation (redox) reaction?

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(2 marks)

- (b) A standard solution of hydrated iron(II) sulphate, $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$, was prepared by dissolving 5.8 g of the salt in a volumetric flask and making it up to 250 mL (250 cm^3). Twenty-five millilitres (25 mL (25 cm^3)) of this solution was acidified and found to react exactly with, 22.8 cm^3 (22.8 mL), of 0.018 M potassium permanganate solution. The half-equations for the reaction are:



- (i) What is the indicator for the titration of a solution of iron (II) sulphate and potassium permanganate solution?

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- (ii) Indicate the colour at the end point if the permanganate is in the burette.

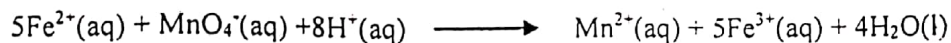
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- (iii) Why is it necessary to acidify the iron(II) solution before titration?

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(3 marks)

(c) The net ionic equation for the reaction is as shown below:



Calculate:

(i) The concentration (mol dm^{-3}) of the iron (II) salt.

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(ii) The number of moles of the salt in 250 cm^3 (250 mL) of solution.

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(iii) The molar mass of the salt,

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(iv) The value of x, the number of molecules of water of crystallization

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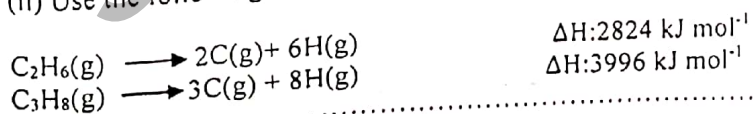
(6 marks)

(d) (i) What do you understand by bond energy term?

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.....

(ii) Use the following data to calculate the C-H and C-C bond energies



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(3 marks)

Turn Over

- (e) (i) Draw the shape of a molecule of a named compound (or species) which has the bond angle indicated.

A. 109.50°

.....

.....

.....

B. 120°

.....

.....

.....

C. 105°

.....

.....

.....

- (ii) Explain the differences in shapes between the molecules of A and B above.

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(5 marks)

- (f) Give two conditions necessary for the formation of a dative bond.

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(1 mark)

(Total: 20 marks)

- 2 (a) A mixture of ethanol (bp 78.5°C) and water (bp 100°C) shows a positive deviation from Raoult's law and forms an azeotropic mixture of boiling point 78.2°C at a composition of 96% ethanol.

(i) State Raoult's Law?

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.....

.....

(ii) What is an azeotropic mixture?

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(iii) Draw a well-labelled diagram of the boiling point against composition of water-ethanol mixture.

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(4 marks)

(b) A mixture of sodium ethanoate and ethanoic acid acts as a buffer.

(i) What is a buffer solution?

(ii) By means of equations show how the buffer solution above acts on addition of small amounts of
A: potassium hydroxide solution

B: Hydrochloric acid

(iii) Calculate the mass of sodium ethanoate which must be dissolved in 1 dm^3 of 0.1 M ethanoic acid to produce a solution with a pH of 5.5 at 298 K. $K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}\text{ mol dm}^{-3}$. Assume that there is no volume change on dissolving the salt.

(6 marks)

(c) Hydrogen peroxide decomposes according to the equation



(i) Give TWO measurable quantities that could be used to monitor the rate of reaction.

(ii) Which of the quantities of a (i) above is most suitable?

(iii) How would this quantity be measured?

(5 marks)

(d) The mass spectrometer is used to determine the relative atomic mass of an element.

(i) Explain the term "relative atomic mass".

(ii) Briefly explain the process by which a sample of an element is ionized.

- (iii) Give two reasons why particles must be ionized before being analyzed.

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(5 marks)

(Total = 20 marks)

SECTION B: INORGANIC CHEMISTRY

- 3 (a) The elements of period 2 of the Periodic Table (Li to Ne) show periodic trends in their properties.

- (i) What is meant by the term "periodic trend"?

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- (ii) How do the following properties vary across the period (Li to Ne)? Explain in each case.

A: Atomic radius.....

Explanation.....

B: First ionization energy.....

Explanation.....

(5 marks)

- (b) For the elements of period 2, give the formula of a hydride which is

- (i) basic and covalent.

- (ii) neutral.....

- (iii) acidic.....

(3 marks)

- (c) (i) With reference to the Group 14 (Group IV) elements (C to Pb), explain the following:

A: Catenation

.....

B: Inert pair effect

.....

- (ii) Give the formula of the chloride of Group 14 (Group IV) element which is

A: Ionic and insoluble in water

.....

B: covalent and is hydrolyzed in water

.....

- (d) Explain the following observations:

(4 marks)

- (i) CCl_4 is stable to heat while PbCl_4 readily decomposes when heated.

.....

- (ii) Carbon dioxide is a gas whereas silicon dioxide is a solid.

.....

.....

(3 marks)

- (e) Give one similarity and one difference between the elements or compounds of carbon and tin.

A: Similarity

.....

.....

B: Difference

.....

.....

(2 marks)

- (f) Using equations only, show how

- (i) ammonia can be prepared in the laboratory

.....

- (ii) a fertilizer can be prepared from a nitrogen compound with oxidation states -3 and +5

.....

(2 marks)

- (g) Give a balanced equation for a reaction in which nitrogen is oxidized and reduced.

.....

(1 mark)

(Total: 20 marks)

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4. (a) (i) List all the metals of the first series of transition metals in order of increasing atomic number.

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- (ii) How does the atomic radius of the elements vary across the series? Explain.

A: Atomic radius

.....

.....

B: Explanation

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.....

(3 marks)

- (b) (i) Give any two properties that are typical of transition elements other than complex formation.

.....

.....

(ii) Using iron as an example, give an illustration of each of the properties stated in 4b(i).

Property	Example

(4 marks)

(c) The Group I elements (Li to Cs) and Group II elements (Be to Ba) are s-block elements.

(i) State and explain how the first ionization energy of the elements vary from Group I to Group II and down the groups

A: From Group I to II.

Explanation.....

B: Down the Groups.....

Explanation.....

(4 marks)

(d) Briefly explain how the following s-block compounds can be prepared

(i) MgO(s)

(ii) NaCl(s)

(4 marks)

(e) What would be observed when

(i) aqueous silver nitrate is added to potassium bromide solution, followed by aqueous ammonia

(ii) concentrated sulphuric acid is added to a small amount of solid potassium iodide in a test tube.

(iii) chlorine water is added to an aqueous solution of potassium iodide

- (iv) Write a balanced equation for the reaction taking place in 4e (iii) above and account for any differences in your observations in 4e(ii) and 4e (iii) above.
Equation

Differences

(5 marks)
(Total = 20 marks)

SECTION C: ORGANIC CHEMISTRY

- 5 (a) This question concerns the following organic compounds:

- A: $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
B: $\text{CH}_3\text{CH}_2\text{CH}_2\text{OCH}_3$
C: $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$
D: $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCl}$

From the above set, select

- (i) Two compounds that are derivatives of carboxylic acids

- (ii) A compound obtained by the reaction of butanoic acid with PCl_5

- (iii) A compound that will give an acid and an alcohol on acid hydrolysis

(5 marks)

- (b) (i) To what class of organic compounds does D belong?

- (ii) Give the structural formula or name of the main organic product formed when compound D reacts with:

A: Benzene in the presence of

AlCl_3

A: LiAlH_4 /dry ether

(3 marks)

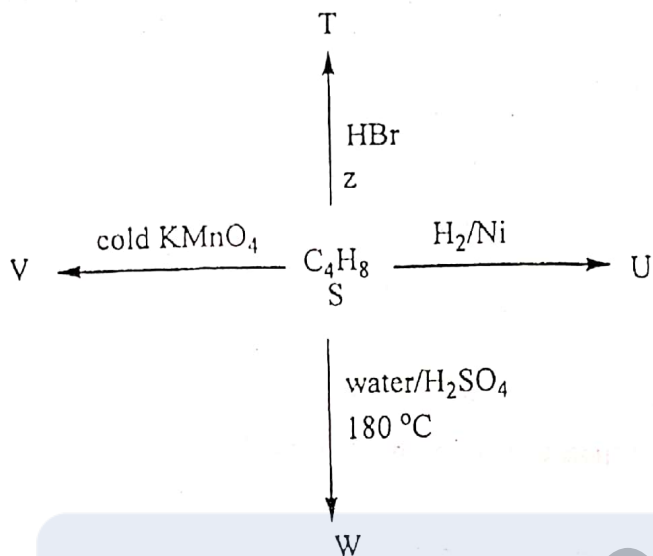
- (c) (i) A and B are isomers. State the type of isomerism involved.

- (ii) Describe a simple chemical test to distinguish between compounds A and B

(3 marks)

10

(d) Study the reaction scheme below for the reactions of but-1-ene (1-butene) and answer the questions that follow



(i) Give the structural formulae and names of the compounds T to W

Compound	Structure	Name
T		
U		
V		
W		

(ii) Name the organic reaction represented by z and outline the mechanism.

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(iii) Would you expect the boiling point of compound V to be higher than that of compound W?

Explain:

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(9 marks)
(Total: 20 marks)

6. (a) An organic compound, X, contains 66.7% carbon, 11.1% hydrogen and 22.2% oxygen. The mass spectrum of X shows a molecular ion at $m/e = 72$

(i) Determine the empirical formula of X.

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(ii) Determine the molecular formula of X

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(iii) Give the structures of three isomers of X

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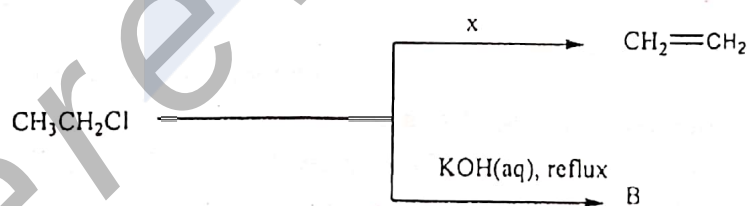
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(b) Give the product formed or reagent and reaction conditions where necessary

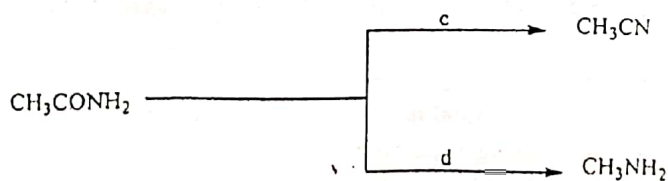
(6 marks)



(2 marks)

X

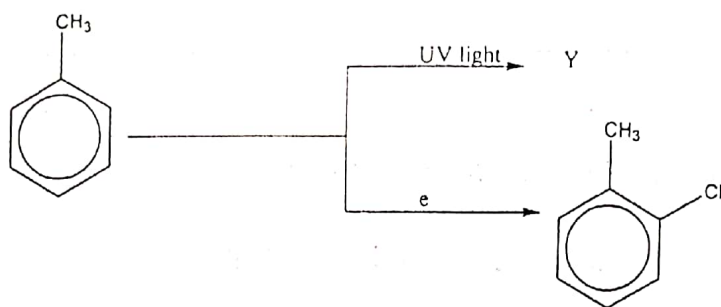
B



(ii)

c.....

d.....

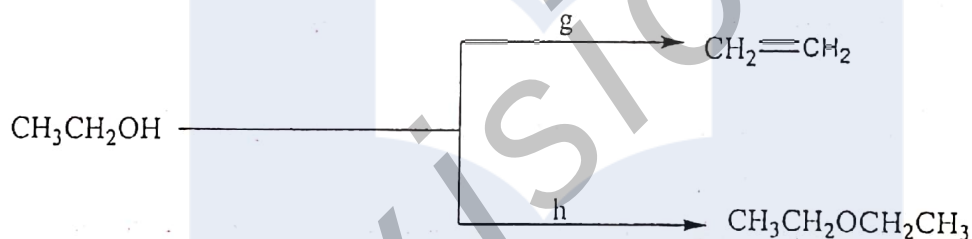


(iii)

Y.....

e.....

(iv)



g.....

h.....

(8 marks)

(c) Give the structural formula and name of a compound that falls under each of the following classes of compounds.

(i) A primary aliphatic amine

.....

(ii) A primary aromatic amine

.....

(iii) An aromatic diazonium salt

.....

(iv) An amino acid

.....

(d) Write an equation to show how the compound in c(iv) above could be prepared. You must indicate the reagents and reaction conditions must be stated.

(4 marks)

(2 marks)
(Total = 20 marks)