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REGISTRATION CENTRE NUMBER	CENTRE NAME
CANDIDATE'S FULL NAMES	
CANDIDATE IDENTIFICATION NUMBER	SUBJECT CODE **_____ 0715** / PAPER NUMBER 2

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CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD ADVANCED LEVEL EXAMINATION

SUBJECT TITLE **CHEMISTRY**	SUBJECT CODE **0715**	PAPER NUMBER 2
	EXAMINATION DATE: **JUNE 2019**	

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.

Verily 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.

Useful Data

Relative atomic masses (RAM)
C= 12.0,0= 16.0, H= 1.0, Al = 27.0, S = 32.0, Na = 23.0 N = 14

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SECTION A: PHYSICAL AND GENERAL CHEMISTRY 1. (a)

1. (i) What is a molar solution?

(ii) Calculate the mass of $Na_2S_2O_3.5H2O$ needed to prepare 250 cm^3 of a 0.011 M solution in a volumetric flask. (RMM = 248)

(2 marks)

(b) Calculate the percentage yield when 2.30 g of ethanol reacts completely with excess ethanoic acid to give 3.52 g of ethyl ethanoate. (RMM: Ethanol = 46; Ethylethanoate = 88.0)

(3 marks)

(c) The radioactive decay of $^{63}_{28}Ni$ $^{63}_{29}Cu$ has a half-1 ife of 120years

(i) Write the equation for the radioactive decay of nickel

(ii) (ii) What do you understand by the half-life of a radioactive isotope?

(iii) Calculate how long it will take for 1.20 g of nickel to be reduced to 0.15 g

(3 marks)

(d) The nitride ion (N^{3-}), the oxide ion (O^{2-}) and the aluminum ion (Al^{3+}) are isoelectronic.

(i) Why are they considered to be isoelectronic ions?

(ii) Arrange the above ions in order of increasing ionic size beginning with the smallest ion.

(2 marks)

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(e) The data below is for the kinetic study of the reaction: A + B → C +D

Concentration of A/mol dm^{-3}	**0.58**	**0.40**	**0.28**	**0.20**	**0.14**
Time/10^2s	**4**	**8**	**12**	**16**	**20**

(i) What is meant by the terms "order of reaction" and "instantaneous rate" as used in chemical kinetics?

(A) Order of reaction:

(B) Instantaneous reaction rate:

(ii) From the data, determine the half-life of the reaction.

(iii) Determine the order of the reaction with respect to A?

(5 marks)

(f) (i) **Define an acid according to Bronsted and Lowry.**

(ii) Phenolphthalein indicator represented by HIn, is a weak acid that dissociates in water as follows:

$$\underset{\text{Colourless}}{HIn(aq)} + \underset{\text{red colour}}{H^+(aq) + In^-(aq)}$$

Explain the colour change observed at the end point of an acid-base titration where phenolphthalein is used as indicator with the acid in the conical flask.

(iii) The pH range of phenolphthalein is 8.2 - 10. Give an acid and an alkali for which phenolphthalein is suitable as an indicator during titration

(iv) The OH^- ion concentration in a dilute ammonia solution is 0.0025 M.Calculate the pH of the solutions

(5 marks)
TOTAL =(20 marks)

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2. (a) Hess's law can be useful in calculating enthalpy changes of reactions that cannot be measured directly..

(i) **State Hess's law.**

(ii) **Given the following data in KJmol^{-1}:**

$C_2H_5OH_{(i)} + 3O_{2(g)} \rightarrow 2CO_2(8) + 3H_2O_{(l)}$ $AH^{[]} = -1370$

$C_2H_{4\,(g)} + 3O_{2\,(g)} \rightarrow 2CO_{2\,(g)} + 2H_2O_{(i)}$ $AH^{[]} = -1415.6$

Determine the enthalpy change when 30.8g of ethanol is produced from the reaction below;
$C_2H_{4\,(g)} + H_2O_{(i)} \rightarrow C_2H_5OH_{(i)}$
(RMM of ethanol = 46).

(4 marks)

(b) **(i) What do you understand by the "coordination number" of an ion in a crystal structure?**

(ii) State the coordination number of the cation in

(A) NaCl..... .....

(B) CsCI..... ... .

(3 marks)

(c) **(i) What is a chemical bond? .**

(ii) **List and locate the different types of bonds that hold particles together in** $NH_4CI\ (s)$

(3 marks)

(d) **Ethanol and carbon disulphide (CS_2) are completely miscible liquids forming a homogenous mixture. On mixing the two liquids, there is a fall in temperature.**

(i) **What do you understand by the term 'homogenous mixture'?**

(ii) **Draw a labelled phase diagram to show the variation of boiling point with composition at constant pressure for a mixture of ethanol and carbon disulphide .**



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(iii) Account for the following

(A) The miscibility of the two liquids

The fall in temperature

(5 marks)

(e) Given the following electrode systems and their electrode potentials

$Ca^{2+}_{(aq)} + 2e \rightarrow Ca(s)$	$É^{o} = -2.87V$
$Fe^{2+}_{(aq)} + 2e \rightarrow Fe(s)$	$E^{0} = -0.44v$
$I_{2(aq)} + 2e \rightarrow 2I^{-}_{(aq)}$	$E^{0} = +0.54\ V$
$Cr_2O_7^{2-}{}_{(aq)} + 14H^{+}_{(aq)} + 6e \rightarrow 2Cr^{3+}_{(aq)} + 7H_2O$	$E^{0} = +1.33\ V$

(i) Arrange the following species: I_2, Fe^{2+}, $Cr_2O_7^{2+}$ and Ca^{2+} in order of decreasing as oxidizing strength.

(ii) What would be observed when granules of calcium are added to a solution of potassium dichromate?

Write a cell diagram when the calcium and iron half cells are coupled and calculate the emf of the cell.

Cell diagram:

Cell e.m.f:

(5 marks)
TOTAL = (20marks)

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SECTION B: INORGANIC CHEMISTRY

3. (a) The Group VII elements of the Periodic Table are called Halogens.

(i) List these elements in order of increasing atomic number indicating their physical states.

(ii) What accounts for the variation in the physical states of the Halogens?

(3 marks)

(b) **(i) Explain why hydrogen bromide and hydrogen iodide cannot be prepared conveniently by reacting their corresponding potassium salts with concentrated sulphuric acid**

(iii) Write a balanced chemical equation showing how hydrogen bromide can be prepared in the laboratory.

3 marks

(c) Most toothpastes are fluorinated and kitchen salt is iodinated. State the importance of

(i) fluorinating tooth paste..... ....

(ii) iodinating kitchen salt……

(d) The elements of Group I and II elements of the Periodic Table are called S-block elements,

(i) Write the valence electronic configurations of the Groups I and II elements

(ii) How do the reactions of the Group II elements with water vary down the group?

Explain the trend.

(i) Write balanced chemical equations to show the reactions of the following elements with cold water.
Na(s):

Mg(s):

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(iv) Arrange the hydroxides of Group II elements (Be to Ba) in decreasing order of solubility beginning with the most soluble.

Explain the trend.

(v) State two ways in which the chemistry of lithium or its compounds differ from those of other alkali elements.

(7 marks)

(e) Nitric acid is manufactured by the catalytic oxidation of ammonia.

(i) Write a balanced equation giving the reaction conditions for the conversion of ammonia to nitrogen monoxide

(ii) Give the formula and name of a compound of nitrogen in the +5 oxidation state commonly used as a fertilizer

(3 marks)

(f) Sulphuric acid is prepared from sulphur dioxide through the reaction $2SO_2$

(g) $+O_2$ (g) $\leftrightarrow 2S0_3$ (g)

(i) State the conditions used to maximize the yield of sulphur trioxide

(ii) What will be observed when sulphur dioxide gas is bubbled through a solution of K MnO_4(aq) ?

(2 **marks)**
Total = (20 marks)

4. (a) Transition metals form complexes by combining with ligands. What is

(i) A transition metal?

(ii) A bidentate ligand?

(2 **marks)**

(b) Copper forms the hydrated complex, $[Cu(H_2O)_6]^{2+}$

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(i) Give the name of the complex ion and draw its shape.

Name of complex:

Shape of complex:

(ii) Give the fonnula of the complex ion formed when a solution of EDTA is added to a solution of $[Cu(H_2O)_6]^{2+}$

(iii) Using the s p d notation, write the electronic configuration of copper in the complex ion.

(4 marks)

(c) Carbon, silicon, germanium, tin and lead are elements of **Group IV (14)** of **the Periodic Table,**

(i) State the variation in structure of the elements carbon to lead.

(ii) Give the name or formula of a chloride of Group IV element that is

A: covalent and decomposes readily at room temperature and pressure (r.t.p.).

B: strongly reducing.

(4 marks)

(d) Write an equation for the reaction of:

(i) Carbon dioxide with aqueous potassium hydroxide.

(ii) Germanium monoxide with dilute hydrochloric acid.

(2 marks)

(c) (i) Give the formula of the stable oxides of the elements of Period 3 in the table below.

Symbol of element	**Na**	**Mg**	**Al**	**Si**	P	**S**	**Cl**	**Ar**
Formula of oxide								

(ii) From the table above, select an amphoteric oxide and write balanced equations to show its reactions with hydrochloric acid and sodium hydroxide.

Amphoteric oxide:

Reaction with HCl(aq):

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Reaction with NaOH(aq):

(iii) Write an equation for the reaction of the oxide of chlorine with water.

(8 marks)
TOTAL = (20 marks)

SECTION C: ORGANIC CHEMISTRY

5. (a) Compound A of molecular mass 103 g/mol contains carbon, hydrogen, nitrogen and oxygen. On analysis it is found to contain 46.6 % carbon, 8.74 % hydrogen, 13.6 % nitrogen and 31.1% oxygen.
Calculate:
(i) The empirical formula of A:

(ii) The molecular formula of A

(iii) How can you identify the presence of nitrogen in compound A? Give the reagents and expected results only.

(b) The organic compound P, named , 2-hyd roxy1propanenitrile exhibits isomerism, (i)

Draw two isomeric structures of P.

(ii) State the type of isomerism exhibited by the two structural forms of P.

(iii) Give a test you would use to distinguish the isomers of P in b(i) above.

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(ii) The compound P can be obtained from the reaction of ethanal and HCN. Write a mechanism for the Reaction.

(iii) What name is given to the type of reaction between this reaction ethanal and HCN?

(8 marks)

(c) Give the reagents and observations to distinguish the following pairs of compounds:

(i) $CH_3CH=CH_2$ and $CH_3C=CH$

(ii) CH_3CHO and CH_3COCH_3

(ii) $CH_3CH_2NH_2$ and CH_3CONH_2

(6 marks)
TOTAL = (20 marks)

6. (a) An organic compound S reacted with ozone (ozonolysis) to give compounds Q and R. Both Q and R react with $NaOH/I_2$ to produce a yellow precipitate with antiseptic smell. Q reacts with HCN to produce the compound $CH_3C(CH_3)OHCN$ while R gives a silver mirror with Tollens reagent.

(i) Write the structural formulae and names of Q,R, S and the yellow precipitate

Substance	formula	Name
Q		
R		
S		
yellow precipitate		

(ii) Write equations to show the reactions of
Q with NaOH/h

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R with $H^+/Cr_2O_7^{2-}$

(10 marks)

(b) Give the reagents and reaction conditions necessary for the following conversions

(i) CH3CH2CONH2 → CH3CH2H2

(ii) CH3CH2OH → CH3CH2OCH2CH3

(iii) CH3CH2NH2 → CH3CH2OH

(6 **marks)**

(c) Use a chemical equation in each case to illustrate the various types of the following organic reactions: (i)

Electrophilic substitution

(ii) Free radical substitution

(iv) Nucleophilic addition

(v) Electrophilic addition.

(4 marks)
Total = (20 marks)

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