REGISTRATION CENTRE NUMBER	CENTRE NAME
CANDIDATE'S FULL NAMES: GCE REVISION	
CANDIDATE IDENTIFICATION NUMBER	SUBJECT CODE: 0715 / PAPER NUMBER: 2

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CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD
ADVANCED LEVEL EXAMINATION

SUBJECT TITLE	SUBJECT CODE	PAPER NUMBER
CHEMISTRY	0715	2
http://www.gcerevision.com	EXAMINATION DATE: JUNE 2020	

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.

Useful Data

Relative atomic masses (RAM)
C = 12.0, O = 16.0, H = 1.0, Al = 27.0, S = 32.0, Na = 23.0, Fe =56

FOR EXAMINERS' USE ONLY	***SCORE***
Marked by: ..... ***Signature:*** ..... ***Date:***	
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SECTION A: PHYSICAL AND GENERAL CHEMISTRY

1. An iron ore contains iron (II) carbonate, $FeCO_3$. The percentage of iron (II) in the ore can be determined by titration with acidified potassium dichromate (VI) . The ionic equation is shown below.

$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6Fe^{2+}(aq) \rightarrow Cr^{3+}(aq) + 6F^{3+}(aq) + 7H_2O(l)$

(a) A 5.00 g sample of the ore was reacted with excess concentrated hydrochloric acid and filtered. The filtrate was made up to 250 cm^3 in a volumetric flask with distilled water. A 25.0 cm^3 sample of the standard solution required 27.30 cm^3 of 0.020 mol dm^{-3} dichromate (VI) solution for complete reaction.

Calculate:

(i) the amount, in moles, of dichromate (VI) ions used in the titration.

.....

.....

.....

.....

(ii) the amount, in moles, of Fe^{2+} ions present in 25 cm^3 of solution

.....

.....

.....

.....

(iii) the mass of iron (II) carbonate present in the ore.

.....

.....

.....

.....

.....i

(iv) the percentage of iron (II) carbonate in the sample

.....

.....

.....

(6 marks)

(b) What do you understand by

(i) Relative atomic mass?

.....

.....

(ii) Isotopes?

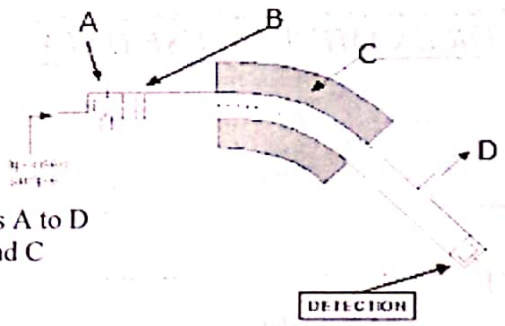
.....

.....

.....

(2 marks)

(c) Consider the diagram of a mass spectrometer below.



(i) On the diagram, label the parts A to D

(ii) State what happens at A, B and C

A:
.....
.....
B:
.....
.....
C:
.....
.....

(5 marks)

(d) The following results were obtained when determining the rate of the reaction

$2NO\ (g) + Cl_2\ (g) \rightarrow 2\ NOCl\ (g)$

Expt	[NO] mol dm^{-3}	$[Cl_2]$ mol dm^{-3}	Initial rate mol $dm^{-3}s^{-1}$
1	0.10	0.10	0.17
2	0.10	0.20	0.35
3	0.20	0.20	1.45

(i) Determine the overall order of the reaction above showing all the steps

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(ii) Consider the reaction below $2N_2O_5\ (g) \rightarrow 4NO_2\ (g) + O_2\ (g)$. The mechanism for the reaction is given as:

$2N_2O_5\ (g) \rightarrow N_2O_3\ (g) + 2NO_2\ (g) + \frac{5}{2}O_2\ (g)$ Slow step

$N_2O_3\ (g) \rightarrow NO\ (g) + NO_2\ (g)$ Fast step

$NO\ (g) + 2N_2O_5\ (g) \rightarrow 3NO_2\ (g) + 2N_2O_5\ (g)$ Fast step

Write down the rate equation for the reaction

(4 marks)

(e) Study the reaction below and answer the questions that follow.

$N_2O_4 \rightleftharpoons 2NO_2\ \Delta H = +243\ kJ\ mol^{-1}$

How does an increase in temperature affect:

A: Equilibrium position _____

_____

B: Equilibrium constant of the above reaction _____

_____

(2 marks)

(f) Identify the acid/base conjugate pairs in the reaction below.

$C_6H_5COO^-(aq) + H_2O(l) \rightarrow C_6H_5COOH(aq) + OH^-(aq)$

_____

(1 mark)

(Total = 20 marks)

Turn Over

(ii) Arrange the group VII elements in order of increasing oxidizing strength.

Explain the trend.

(iii) Write balanced chemical equations to show the reactions of $Cl_{2\,(g)}$ with

A) Cold dilute KOH

B) Hot concentrated KOH.

(iv) Give the formulae and names of the oxo-acids of iodine in the following oxidation states:

Oxidation state	Formula	Name
+1		
+5		

(7 marks)

(b) (i) How does the second ionization energy vary for group Iand group II elements in the same period of the Periodic Table.

Give a reason for your trend

(ii) Lithium shows a diagonal relationship with magnesium.

A) Why are these elements diagonally related?

B) Give one reaction in which Li and Mg show a diagonal relationship.

(iii) With the use of chemical equations show the effect of heat on the nitrates of lithium and potassium.

$LiNO_3$

KNO_3

(iv) How does the solubility of hydroxides of the group II elements vary down the group?.

(7 marks)

(c) (i) In the space below sketch a graph of variation of the first ionization energy for the elements Sodium to Argon.

(ii) In Complete the table below giving the formulae of the oxides of the elements

Element	Li	Be	B	C	N	F
Formula of stable oxide						

(iii) From the list of oxides in c (ii) select an oxide which is likely to be:
Amphoteric: _____
Neutral: _____
Acidic: _____

(6 marks)
(TOTAL = 20 marks)

4. This question concerns the d-block elements, Sulphur, Nitrogen and Group IV elements,.

(a) (i) Distinguish between a d-block element and a transition metal.

(ii) Write down the symbols for the elements of the first transition series in increasing order of atomic number.

(iii) State the property of the transition element which enables them to act as catalyst in many industrial processes.

(4 marks)

(b) Consider the following complex compound $[Na_4Fe(CN)_6]$
(i) Give the name of the complex the compound above.

(ii) State
A) the coordination number of iron in the complex compound

B) the oxidation state of iron in the complex compound

(iii) Draw the structure of the complex ion in b (i) and give its shape.

(5 marks)

(c) Give the formula of a fertilizer containing nitrogen and sulphur atoms and state the oxidation state of nitrogen and sulphur in the compound.

Formula of fertilizer	Oxidation state of Nitrogen	Oxidation state of sulphur

(3 marks)

Turn Over

(d) (i) Give two differences in chemical property between carbon or its compounds and the rest of the group IV elements.

(2 marks)

(ii) Catenation and "the inert pair effect" are two phenomena that characterize the chemistry of the Group IV elements. What do you understand by;

A. Catenation?

B. Inert pair effect?

(iii) Explain why carbon shows a very high ability to catenate?

(3 marks)

(e) The group IV elements also exhibit allotropy.

(i) What is allotropy?

(ii) Give two crystalline forms of each of the following group IV elements:

Carbon

Tin

(3 marks)

(TOTAL = 20 Marks)

SECTION C: ORGANIC CHEMISTRY

5. This question relates to organic compounds and their reactions.
An organic compound A contains hydrogen, carbon, chlorine and a double bond.

(a) How would you identify the presence of

(i) A double bond

(ii) Chlorine

(4 marks)

(b) (i) If 0.485 g of the compound, A, contains 0.120 g of carbon, 0.01 g of hydrogen, calculate the empirical formula of the compound.

(2 marks)

(ii) 0.485 g of compound A reacted completely with 1.700 g of silver nitrate in the ratio 1:2. (Molar mass of silver nitrate is 170 g/mol). Determine

A. The molar mass of compound A

B. The molecular formula of compound A

(4 marks)

(c) Give two isomers of compound A

(2 marks)

(d) (i) Complete the table below by giving the structure and name of a primary, secondary and tertiary amine with molecular formula C_3H_9N

Class	Structure	Name
1°		
2°		
3°		

(ii) Primary amines can be prepared from amides by Hoffmann's degradation.

(a) Write a general equation for the reaction.

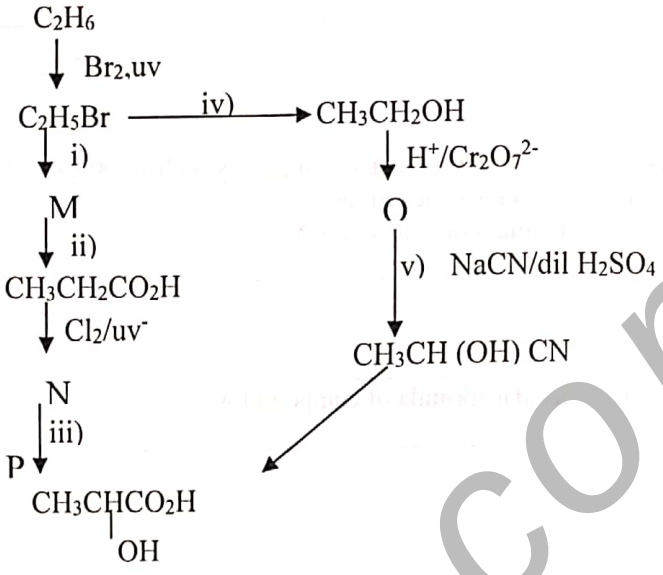
(b) Give reagents and reaction conditions for the reaction.

(iii) What feature of amines is responsible for their being basic?

(iv) Suggest one way of increasing the basicity of an amine.

(8 marks)
(Total = 20 marks)

6. Study the reaction pathways below from which compound P may be prepared from ethane, and answer the questions that follow.



(a) Give the reagents and reaction conditions for the conversions (i), (ii), (iii) and (iv)

	Reagent(s)	Reaction conditions
(i)		
(ii)		
(iii)		
(iv)		

(4 marks)

(b) (i) Give the names of the compounds M, O and P.

Compound	Name
M	
O	
P	

(ii) Name the type of organic reactions in steps (i) and (v)

Step (i) _____

Step (v) _____

(5 marks)

(c) By means of a chemical test, how would you distinguish the following pairs of compounds. State reagents and reaction conditions.

(i) propanal and propanone

_____

_____

_____

(ii) Ethene and Ethyne

_____

_____

_____

(4 marks)

(d) Outline the mechanism for the conversion of benzene to methylbenzene

_____

_____

_____

_____

(2 marks)

(e) 2-aminopropanoic acid ($CH_3CH(NH_2)CO_2H$) is amphoteric in nature.

(i) Write chemical equations to show the reaction of 2-aminopropanoic acid with:

A- $HNO_{3(aq)}$ _____

_____

B- NaOH(aq) _____

_____

(ii) Give the structure and general name of 2-aminopropanoic acid when in a neutral solution of pH = 7.

- Structure
- Name _____

(iii) Draw the stereo isomers of 2-aminopropanoic acid.

_____

_____

(5 marks)

(Total = 20 marks)