CAMEROON GENERAL CERTIFICATE OF EDUCATION MOCK EXAMINATION
CHRISTIAN COMPREHENSIVE SECONDARY SCHOOL YAOUNDE
0715 CHEMISTRY 2 2020 /2021 ADVANCED LEVEL

Centre No. & Name	
Candidate No.	
Candidate Name	

0715 CHEMISTRY 2: PAPER II

TWO AND HALF hours

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you start answering the questions in this paper.

Enter the information required in the boxes of the flap

Answer all the six question 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 statement showing how the answers have been obtained. Calculators may be used.

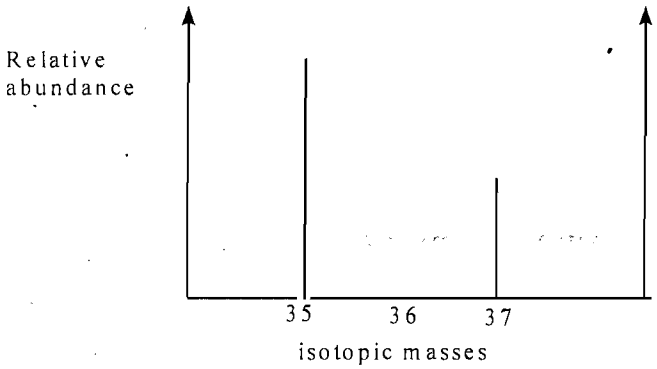
USEFUL DATA

Relative Atomic Masses
Aluminium (Al) = 27.0
Manganese Mn = 55.0
Hydrogen (H) = 1.0
Oxygen (O) = 16.0
Sodium (Na) = 23.0
sulphur S =32.0
iron Fe = 56.0

G.M.V of any gas at r.t.p. = 24000cm^3
1 faraday = 96000 coulombs

SECTION A: PHYSICAL AND GENERAL CHEMISTRY

1. The diagram shows the mass spectrum of chlorine, atomic number 17. The relative atomic mass of chlorine can be obtained from the spectrum.



(a) (i) What do you understand by "Relative atomic mass"?

(ii) From the spectrum, give the masses of the two isotopes.

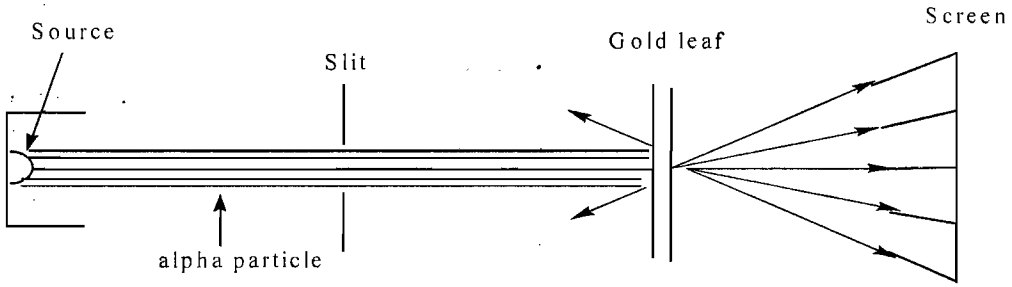
(iii) Give the number of protons, neutrons and electrons in each isotope.

Isotope	Protons	Neutrons	Electrons
Isotope 1			
Isotope 2			

(i) Given that the relative abundances are 75.53 and 24.47 percent respectively. Calculate the relative atomic mass of chlorine.

(6mks)

(b) Below is the diagram of the Rutherford gold-leaf experiment used in the determination of the structure of the atom.



(i) Give one possible source of alpha particles.

(ii) State the mass and the charge of the alpha particle.

(iii) Give two observations that were obtained from the experiment.

(iv) State FOUR conclusions that were obtained from Rutherford's experiment.

(8mks)

(c) The first and second ionization energies of argon (atomic number 18) are 1521KJmol^{-1} and 2666KJmol^{-1} respectively and for potassium (atomic number 19) are 419KJmol^{-1} and 3051KJmol^{-1} respectively.

(i) Give TWO reasons to explain the differences in the first and second ionization energies of:

Argon

Potassium

(ii) Write the electronic configuration of the ion K^{2+} (using the *s,p,d* notation).

(iii) What information can be obtained about the arrangement of electrons in atoms from ionization energies?

(6mks)

[Total = 20 marks]

2. You are given the following data

Process	VH^{o} KJmol^{-1}
A: $K_{(s)} \longrightarrow K_{(g)}$	+90
B: $Cl_{2(g)} \longrightarrow 2Cl_{(g)}$	+121
C: $K_{(g)} \longrightarrow K^{+}_{(g)}$	+418
D: $Cl_{(g)} \longrightarrow Cl^{-}_{(g)}$	-364
E : $K^{+}_{(g)} \longrightarrow K^{+}_{(aq)}$	-322
F : $Cl^{-}_{(g)} \longrightarrow Cl^{-}_{(aq)}$	-364
G : $K^{+}_{(g)} + Cl^{-}_{(g)} \longrightarrow KCl_{(s)}$	-701

(a) (i) Use the data to construct a Born-Haber cycle for the formation of potassium chloride.

(ii) What bonds are broken in the atomization of;

Potassium

Chlorine

(iii) Sketch a labeled diagram to show the type of bonding in solid potassium.

(iv) Calculate the heat of hydration for potassium chloride

(6mks)

(b) (i) Sketch the dot and cross models to represent the species $[CuCl_4]^{2-}$ and NH_3BF_3.

(ii) Indicate in the model a dative covalent bond and a simple covalent bond.

(iii) Sketch the shape and predict the bond angels of the species NH_3BF_3.

(5mks)

(c) Hydrogen bonding is an example of an intermolecular force. Intermolecular forces influence the physical properties of substances.

(i) Why does water (H_2O), has hydrogen bonding whereas hydrogen sulphide (H_2S), has none?

(ii) In the table below, state a named physical property and a named example where the intermolecular force has influenced the physical property.

	Named physical property	Specific example
Van der Waal forces		
Hydrogen bonding		

(5mks)

(d) (i) From the data below, draw an energy cycle diagram for the formation of propane (C_3H_8) and calculate the heat of formation.

$\Delta H_C^o(C_3H_8) = -890KJmol^{-1}$, $\Delta H_C^o(H_2) = -286KJmol^{-1}$, $\Delta H_C^o(C_{(s)}) = +394KJmol^{-1}$

(ii) By what other means could the ΔH, for propane be obtained?

(4mks)

[Total = 20 marks]

SECTION B: INORGANIC CHEMISTRY

3. (a) The group IV elements, C, Si, Ge, Sn and Pb form compounds in either the +2 or +4 oxidation states.

(i) State the trend and explain the stability of the +2 and +4 oxidation states among the elements.

(ii) The group IV elements have the ability to catenate. What is meant by catenation?

Arrange the elements in order of increasing ability to catenate.

(iii) State one way in which the element carbon is chemically

A: Similar to the rest of the elements.

B: Different from the rest of the elements.

(6mks)

(b) The d-block elements characteristically form complex ions and show variable oxidation states in their compounds.

(i) What is a d-block element?

_____

_____

_____

(ii) Give one reason in each case to explain why d-block elements;

A: form complexes

_____

_____

_____

B: show variable oxidation states.

_____

_____(3mks)

(c) Given the following complex compound: $[Cr(H_2O)_6]Cl_3$

(i) Identify the ligands in the complex compound.

_____

_____

(ii) Give the structural formulae of two isomers of the compound and state their systematic names.

Isomer	Name

(iii) What is the coordination number and oxidation state of chromium in the complex?

Coordination number	
Oxidation state	

(iv) State the electron configuration of chromium in the complex using s, p, d notation (atomic number = 24).

_____

_(6mks)

(a) (i) Complete the following table that concerns the halogens.

Element	Physical state at 25oC
Fluorine	
Chlorine	
Bromine	
Iodine	

(ii) Explain the change in the physical states of the substances.

_____

(iii) Write an equation in each case to show how HCl and HI could be prepared from solid NaCl and NaI respectively.

(5mks)

[Total = 20 marks]

4. These equations concern some elements of group I and II and period 2 and 3 of the periodic table.

(a) Give the formulae of the simple oxides of the elements in the table.

Element	Sodium	Phosphorus	Sulphur	Aluminium
Oxide				

(4mks)

(b) Write an equation in each case to show how

(i) The oxide of sodium reacts with an acid.

(ii) The oxide of phosphorus reacts with a base.

(iii) The oxide of aluminium reacts with

A: An acid

B: A base

(4mks)

(c) Give the reaction of the following chlorides with water.

(i) PCl_5

(ii) $MgCl_2$

(iii) ACl_3

(3mks)

(d) From the following group I and II elements; Li, Na, K, Mg, Ca, Sr, Ba: choose the element:

(i) With the smallest first ionization energy

(ii) With the smallest atomic radius

(iii) With the highest melting point

(3mks)

(e) Write a reaction in which lithium

(i) Behaves like magnesium

_____

(ii) Behaves like sodium

_____(2mks)

(f) Explain how a pure sample of $AlCl_3$ can be produced in the laboratory from pure Al metal.

_____

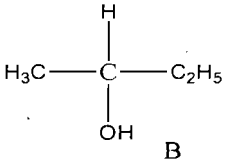
_____(4mks)

[Total = 20 marks]

SECTION C: ORGANIC CHEMISTRY

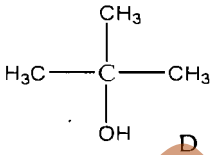
5. This question concerns the compounds A to E shown below.

$CH_3CH_2CH_2OH$ (A)

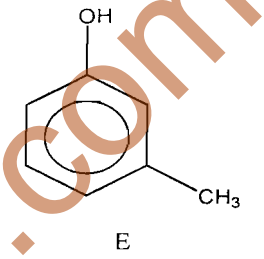


B

$CH_3CH_2OCH_2CH_3$ (C)



D



E

(a) Using the letters A to E, identify the compounds which are

(i) Of the same homologous series_____ and are structural isomers_____

(ii) Choose a PAIR that shows functional group isomerism.

_____(3mks)

(b) Give the molecular formula of B and its systematic name

Molecular formula_____

Systematic name_____(2mks)

(c) Identify (i) a primary alcohol_____

(ii) a tertiary alcohol_____(2mks)

(d) State what would be observed and the product when D is treated with conc. $HCl/ZnCl_2$ (Lucas reagent) and warmed.

_____(2mks)

(e) (i) What compound is obtained when A and B react separately with acidified potassium dichromate

A: _____

B: _____

(ii) How would the products of the reactions of e(i) above be distinguished by means of a chemical test/give reagents, reaction conditions and observations.

_____

_____(4mks)

(f) When D is treated with conc H_2SO_4 at 170°C it gives a compound F, give the structure of F. _____(1mk)

(g) (i) Which one of the two A or B will have the highest boiling point? Why

_____

_____

(ii) What is the most common use of C in the Laboratory and what precautions must be taken when using C.

Use _____

Precaution _____(4mks)

(h) Give the product(s) (if any) when A and E are separately treated with bromine water.

A_____

B: _____(2mks)

[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/ I_2.

_____

R with $H^+/ Cr2O_7^{2-}$

_____(10mks)

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

(i) $CH_3CH_2CONH_2 \longrightarrow CH_3CH_2NH_2$

_____

(ii) $CH_3CH_2OH \longrightarrow CH_3CH_2OCH_2CH_3$

_____

(iii) $CH_3CH_2NH_2 \longrightarrow CH_3CH_2OH$

_____(6mks)

(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.

_____

(iii) Nucleophilic addition.

_____

(iv) Electrophilic addition.

_____(4mks)

[TOTAL = 20 marks]