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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER
SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 310

COURSE TITLE: COMPARATIVE STUDY OF S AND P BLOCK
ELEMENTS

DURATION: 2 HOURS

DATE: 03/10/2018 **TIME:** 11.30 – 1.30 PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 3 printed pages. Please Turn Over



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SECTION A (30 MARKS)

QUESTION 1

- (a) Define the following terms as applied in the chemistry of S and P block elements. (5mks)
- Electronegativity
 - Ionization
 - Allotropy
 - Inert pair effect
 - Catenation
- (b) Which of the following elements Carbon, Silicon and Germanium has atoms with the greatest polarizability? Explain. (2mks)
- (c) Lithium differs from the other group (I) elements in its chemical and physical properties. State two physical and two chemical differences between Lithium and other in group (I) elements. (4mks)
- (d) Explain the following observation;
- A mass spectrograph of Chlorine shows five particles with selective masses 35,37,70,74. (2mks)
 - Halogens become weaker oxidizing agents as we move down the group.(1mk)
 - HF has a higher boiling point than HCl and HI.(2mks)
- (e) Silicon dioxide and silicon tetrachloride are both covalent but their melting point is very different being 1610°C and -70°C respectively.
- Give the name and type of structure present in each of the compounds.(2mks)
 - Explain how the melting point is related to their structure. (2marks)
- (f) Compare the properties of water and liquid ammonia as solvents of group (I) metals. (4mks)
- (g) Explain the trivalency and monovalency of group (III) elements.(4mks)
- (h) Explain why a diagonal relationship exists between lithium and magnesium.(2mks)

QUESTION 2 (20 MARKS)

(a) Carbon is the 17th most abundant elements by mass on earth. It exists as isotopes and can react with some elements to form carbides.

i. Name the isotopes of carbon. (3mks)

ii. With the help of examples, explain the three categories of carbides that carbon is likely to form. (6mks)

iii. State any two uses of carbon. (2mks)

(b) Nitrogen is the most important component of the earth's atmosphere. It is an essential constituent of a plant and animal tissues.

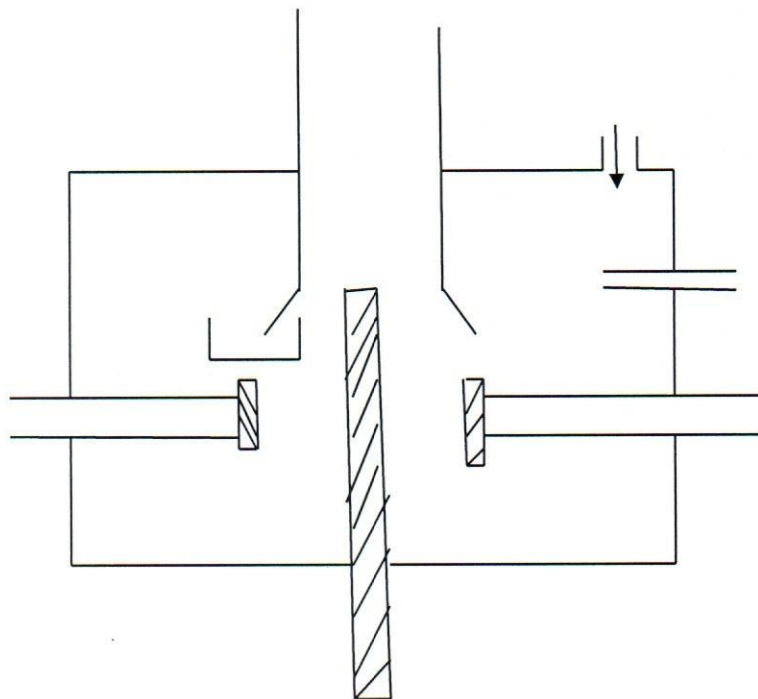
i. State any hydrides that nitrogen is likely to form. (2mks)

ii. Nitric acid is an important oxo acid of nitrogen. By use of chemical equation, illustrate how the acid can be prepared in industries. (5mks)

iii. Write a balanced chemical equation to show reaction of dilute nitric acid and magnesium metal. (2mks)

QUESTION 3 (20 MARKS)

(a) The diagram below shows the 'Downs processes for the extraction of sodium metal. Study it and answer the questions below.



- i. State the major drawback of this process. (1mk)
 - ii. Explain how the difficulty in (i) above is overcome. (2mks)
 - iii. Write the chemical equations and the overall reaction equation of the cell. (2mks)
 - iv. After manufacture, explain how sodium metal is stored. (2mks)
 - v. State any two uses of sodium and its compounds. (2mks)
- (b) Elements of group 18 no longer satisfy the title 'inert' or 'rare' gases. Explain. (2mks)
- (c) State any three uses of argon. (3mks)
- (d) Xenon and Fluorine combine on heating and the products formed when the reaction factors are ; (2mks)
- i. 2:1 for Xe or F₂ respectively .
 - ii. 1:2 for Xe and F₂ respectively.

QUESTION 4 (20 MARKS)

(a) 0.347g of metal (A) was dissolved in dilute HNO₃. This solution gave a red colouration a non luminous Benzene burner flame and on evaporation gave 0.747g of metal oxide (B). (A) above reacted with nitrogen, forming a compound (C) and with hydrogen forming (D) . On reacting 0.159g of (D) with water, a gas (E) was evolved and sparingly soluble compound (F) formed which gave a strongly basic reaction and required 200ml of 0.1M hydrochloric acid to neutralize it. Identify the substance (A) to (F) and write the balanced chemical equations for the reactions forming compounds (B), (C), (D) and (E). (7mks)

(b) The atomic radius of lithium is (23A⁰ when the outermost 25 electrons is ionised off. The ionic radii of Li⁺ is 0.76A⁰. Assuming that the difference in radii relate to the space occupied by the 25 electrons, calculate the percentage of the volume of the lithium atom that is occupied by the valence electron. (3marks)

(c) The density of the anhydrous aluminium chloride was measured at 200⁰c, 600⁰c and 800⁰c at atmospheric pressure and results are given below.

Temperature in ⁰ c	200	600	800
Density in g/cm ³	6.9	2.7	1.5

i. Calculate the relative molecular mass of anhydrous aluminium chloride vapour at each temperature.

R= 8.31 J/K. (2mks)

ii. What is the probable molecular formula of aluminium chloride vapour at 200⁰c and 800⁰c. (Al=27.0, Cl=35) (2mks)

iii. Outline the laboratory preparation of anhydrous Aluminium chloride from aluminium. (4mks)

(d) Explain why the conductivity of the Li^+ (ion) is atomically to water. (2mks)

QUESTION 5 (20 MARKS)

(a) Write a balanced chemical equation for the reaction between concentrated Sulphuric acid and ;

i. Hydrogen sulphide. (1^{1/2} mks)

ii. Sulphur. (1^{1/2} mks)

(b) Three of the oxoacids of phosphorus have the formula H_3PO_3 , H_3PO_4 , H_3PO_2 .

i. Name the three acids. (1^{1/2} mks)

ii. Draw their full structural formulae. (2 mks)

iii. Draw a diagram to show the expected shape and bond in a molecule of phosphorus chloride. (2 mks)

iv. Phosphorus is also a pentachloride, PCl_5 , which is thought to exist in the solid form as $[\text{PCl}_4]^+$, $[\text{PCl}_6]^-$ the shapes of these ions. (2mks)

(c) Elements frequently form hydrated salts unlike the corresponding compounds of group I elements are anhydrous. Suggest reasons for these difference. (2mks)

(d) Magnesium and calcium occur naturally in the mineral dolomite, MgCO_3 , CaCO_3 , a mixture of the insoluble magnesium and calcium carbonate which can be used to produce calcium sulphate and magnesium sulphate is used in the manufacturing of building materials such as plaster board. Magnesium sulphate is used in the fire proofing fabrics and an Epsom salts.

(e) Describe carefully how you would prepare samples of $\text{Mg}_3\text{O}_4 \cdot 7\text{H}_2\text{O}$ and CaSO_4 from dolomite. (3mks)

You may find the following information useful.

Compound	Solubility per 100g of H_2O of 20°
MgCO_3	0.01
CO_3	0.0014
MgSO_4	33.0
CaSO_4	0.21

(b) How would you obtain pure MgSO_4 from crystals of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$. (2mks)