KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2016/2017 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY 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: 18TH SEPTEMBER 2017 **TIME:** 2:30 – 5:30PM

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

QUESTION 1

1 (a) (i) Explain why the conductivity of the Li+ ion is abnormally low............................ (2)

(ii) Explain why aluminium chloride is covalent whereas aluminium fluoride is ionic...(2)

(b)   Sulphur cartenates more than group vi elements.

(i) Define the term Cartenation..(1/2)

(ii) Give an example of a species in which sulphur cartenates....................................(1/2)

(c)Beryllium chloride is substantially covalent but the chlorides of group 2A become more ionic on going down the group, so that Barium sulphate is almost purely ionic. Explain this observation.. (2)

(d) Explain using equations why an aqueous solution of aluminium chloride is acidic..... (2)

(e) (i) State the storage equipment for alkali metals.. (1)

(ii) Write balanced chemical equations for the following reactions

[I] Potassium heated in chlorine gas...(1 ½)

[II] Sodium heated in a stream of ammonia gas...(1 ½)

(f) The following table shows the physical data for the halogen hydrides.

Halogen hydrides	Boiling point(^{o}C)	Ka	Bond dissociation energy KJ/Mol
Hydrogen Flouride	19.5	10^{-4}	562
Hydrogen Chloride	-85.0	10^{7}	431
Hydrogen Bromide	-67.0	10^{9}	366
Hydrogen Iodide	-35.0	10^{11}	298

(i)   Account for the boiling point of the hydrogen halides.................................... (1)
(ii)   Arrange the hydrogen halides in order of increasing acidity and account for the order...(2)
(iii) Explain why a solution of hydrogen chloride in methylbenzene does not conduct electricity, while in aqueous solution it behaves as a strong electrolyte.............(1)

(g) Write a balanced chemical equation for the reaction between concentrated sulphuric acid and

(i)   Hydrogen Sulphide..(1 ½)
(ii)   Sulphur..(1 ½)
(iii) Glucose..(1 ½)

(h) Three of the Oxoacids of Phosphorus have the formula H_3PO_3, H_3PO_4 and H_3PO_2

    (i)   Name the three acids..(1 ½)

    (ii)   Draw their full structural formulae...(3)

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

    (iv)   Phosphorus also forms a pentachloride, PCl_5, which is thought to exist in the solid form as $[PCl_4]^+$, $[PCl_6]^-$; suggest the shapes of these ions.   (2)

SECTION B

Question 2

  (a) The behaviour of the hydrides of the elements Na – Ar with water is summarized below

NaH	MgH$_2$	AlH$_3$	SiH$_4$	PH$_3$	H$_2$S	HCl
React forming H$_2$(g) and an alkaline solution			No reaction	Reacts forming a slight alkaline solution	Reacts to form a slightly acidic solution	Reacts to form an acidic solution

    (i)   Write equations to summarize the reactions of NaH and MgH$_2$ with water........(2)

    (ii)   Suggest a reason why SiH$_4$ has no reaction with water....................................(1)

    (iii)   Write an equation to account for the formation of a slightly alkaline solution when PH$_3$ reacts with H$_2$O...(2)

    (iv)   Write an equation to account for the formation of an acidic solution when HCl reacts with water...   (2)

(b)(i) Beryllium shows certain properties that are not typical of the rest of the group. Mention two of these properties and suggest reasons why the difference should occur.........(4)

  (ii) Group II elements frequently form hydrated salts while the corresponding compounds of group 1 elements are anhydrous. Suggest reasons for this difference...............................(3)

(c)Magnesium and Calcium occur naturally in the mineral dolomite, $MgCO_3.CaCO_3$, a mixture of insoluble Magnesium and Calcium Carbonates which can be used to produce Calcium Sulphate and Magnesium Sulphate. Calcium Sulphate is used in the manufacture of building materials such as plaster – board. Magnesium Sulphate is used in fire proofing fabrics and an Epsom salts.

(i) Describe carefully how you would prepare samples of $MgSO_4.7H_2O$ and $CaSO_4$ from dolomite. You may find the following information useful...(4)

Compound	Solubility per 100g of water at 20^oC
$MgSO_4$	0.01
$CaCO_3$	0.0014
$MgSO_4$	33.0
$CaSO_4$	0.21

(b) How would you obtain pure $MgSO_4$ from crystals of $MgSO_4.7H_2O$......................(2)

QUESTION 3

(a) The density of anhydrous aluminium chloride vapour was measured at 200^oC, 600^oC and 800^oC at atmospheric pressure and the results are given below.

Temperature/^oC	200	600	800
Density g/cm^3	6.9	2.7	1.5

    (i)   Calculate the relative molecular mass of anhydrous aluminium chloride vapour at each temperature. R = 8.31J/K..(2)

    (ii)   What is the probable molecular formula of aluminium chloride vapour at 200^oC and 800^oC.(Al = 27.0, Cl = 35.5)... (2)

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

(b)The first step in the manufacture of nitric acid from ammonia involves the exothermic oxidation of ammonia to nitrogen oxide (NO) and steam.

   (i) Write the equation for the reaction of ammonia with oxygen to form nitrogen oxide and steam.. (1 ½)

   (ii) Predict qualitatively the conditions of temperature and pressure for maximum yield of nitrogen oxide in the equilibrium mixture.. (1 ½)

   (iii)Describe with equations how nitrogen oxide produced by this process is converted to nitric acid.. (4)

   (c) Explain the following observations:
    (i)   A mass spectrograph of chlorine shows five particles with relative masses 35, 37, 70, 72, 74... (2)
    (ii)   Halogens become weaker oxidising agents as we move down the group.... (1)
    (iii) HF has a higher boiling point than HCl and HI....................................... (2)

QUESTION 4

(a) (i) Define the term bond angle ....(1)

(ii) Explain why Berylium chloride is a linear molecule whereas tin chloride is a trigonal planar.. (3)

 (b) Compare the stability of oxo salts of group 1 and group 2 elements with reference to

 (i)Nitrates... (2)

(ii) Carbonates... (2)

(c)With reference to reactions with alkalis and acids, show the difference in nature of aluminium hydroxide with that of magnesium hydroxide... (4)

(d) CO_2 and SiO_2 are both acidic but SiO_2 is solid of high melting point whereas Co_2 is a gas at room temperature. Explain .... (2).

(e)(i) Explain the term silicones....................................(2)

 (ii) List four applications of silicones.......... (4)