



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BTAC 15

ACH 4201 : S AND P BLOCK ELEMENTS

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: 14 Dec 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

(a) Explain briefly and concisely, the following observations or facts

(i) Li chemistry is almost similar to the chemistry of group II members. [2mks]

(ii) Glass made from boron or Al are more superior in quality than those made from Na_2O or K_2O [2mks]

(iii) Group III metals are much harder than group I [1mk]

(iv) Group I metals form mainly anhydrous salts [2mks]

(v) The covalent radius of Al is roughly 1.4\AA , while that of Ga is 1.23\AA yet Ga is below Al on the periodic table [2mks]

(vi) Explain why, caesium is stored under liquid hydrocarbons or in a sealed [2mks]

(vii) Down the group 3 members the formula of halides changes from MX_3 to MX [2mks]

(viii) KO_2 exist, but K_2O does not exist [2mks]

(ix) The only binary compounds of noble gases are fluorides and oxides. [1mk]

(b) Using stoichiometric equations state three diagonal relationships between Li and Mg.

[6mks]

(c) The table below represents some properties of the hydrides of group 6 elements. Use the information contained in the table and answer question that follow.

Hydride	ΔH of formation	Bond angle	Boiling point °C
H ₂ O	-242	H-O-H, 104°28'	100
H ₂ S	-20	H-S-H, 92°	- 60
H ₂ Se	+81	H-Se-H, 91°	- 42
H ₂ Te	+154	H-Te-H, 89°	- 2.3

Explain the trends in;

- i. Stability of the hydrides. [2mks]
- ii. Bond angle [3mks]
- iii. Boiling point [3mks]

Question TWO

(a) Compare and contrast the formulas and stabilities of the oxidation states of the common nitrogen chlorides and phosphorous chlorides. [6mks]

(b) Explain why in; $\text{NH}_3 \rightarrow \text{BF}_3$, the **B—F** the distance is 1.38Å, and in $\text{Me}_3\text{N} \rightarrow \text{BF}_3$ the distance **B—F** is 1.39Å, which are much longer than the 1.3Å in **BF₃** [3mks]

(c)

(i) State the three essential conditions necessary for Haber process [4mks]

(ii) State two sources for the raw material used in Haber process [4mks]

(d) State three economic importance of NH₃ [3mks]

Question THREE

(a) Suggest reasons for and against inclusion of H in the main group elements [3mks]

(b) What is meant by 'hydrogen gap'? How does it a rise [2mks]

(c) Write down the general chemical equations for the reaction between hydrides of group I and group II with water [2mks]

(d)

(i) Give the other name for 'inorganic benzene' [1mk]

(ii) How is it different from benzene [1mk]

(e) State three differences between carbon and silicon which attributes to the differences between alkanes and silanes [3mks]

(f) Explain why trimethylamine is a Lewis base but trisilylamine is not. [3mks]

(g) Starting with SiCl₄, illustrate how silicone of benzene derivative can be prepared. [5mks]

Question FOUR

(a) Using examples explain how the chemistry of sodium is closely related to that of calcium metal [4marks]

- (b) Explain how one can establish the presence of sodium metal from its ore. [1mk]
- (c) State and write down the formula for the main ore of sodium metal [2mk]
- (d) State the main raw materials required for extraction of Na [1mk]
- (e) Using chemical equations explain the chemical process involved in recovering sodium metal from its ore [7mks]
- (f) State two economic importance of sodium [1mk]
- (g) Explain how tetraethyl lead $[Pb(C_2H_5)_4]$, which is gasoline additive is prepared? State the challenges attached to its use [2mks]

Question FIVE

- (a) State and write the formula of the chief constituent of Portland cement [2mks]
- (b) Using explain the differences between permanent and temporary hardness of water [4mks]
- (c) Explain how water hardness can be removed [6mks]
- (d) State the raw materials required for large production of ammonia gas [2mks]
- (e) State the condition required for Haber process [3mks]
- (f) State why ammonium phosphate is more superior fertilizer than urea [3mks]

APPENDIX

Periodic Table of the Elements

1 H Hydrogen 1.008	2 He Helium 4.003																	13 B Boron 10.811	14 C Carbon 12.011	15 N Nitrogen 14.007	16 O Oxygen 15.999	17 F Fluorine 18.998	18 Ne Neon 20.180
3 Li Lithium 6.941	4 Be Beryllium 9.012																	5 Al Aluminum 26.982	6 Si Silicon 28.086	7 P Phosphorus 30.974	8 S Sulfur 32.066	9 Cl Chlorine 35.453	10 Ar Argon 39.948
11 Na Sodium 22.990	12 Mg Magnesium 24.305	3 Sc Scandium 44.956	4 Ti Titanium 47.867	5 V Vanadium 50.942	6 Cr Chromium 51.996	7 Mn Manganese 54.938	8 Fe Iron 55.845	9 Co Cobalt 58.933	10 Ni Nickel 58.693	11 Cu Copper 63.546	12 Zn Zinc 65.38	13 Ga Gallium 69.723	14 Ge Germanium 72.631	15 As Arsenic 74.922	16 Se Selenium 78.971	17 Br Bromine 79.904	18 Kr Krypton 84.738						
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 84.738						
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.908	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.711	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294						
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.227	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [209]	85 At Astatine 209	86 Rn Radon 222.018						
87 Fr Francium 223.029	88 Ra Radium 226.025	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [293]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown						
57 La Lanthanum 138.905	58 Ce Cerium 140.116	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.243	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.055	71 Lu Lutetium 174.967									
89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.085	101 Md Mendelevium 268.1	102 No Nobelium 269.101	103 Lr Lawrencium [262]									

Alkali Metal

Alkaline Earth

Transition Metal

Basic Metal

Semimetal

Nonmetal

Halogen

Noble Gas

Lanthanide

Actinide

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