MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST SEMESTER EXAMINATION FOR DIPLOMA IN EDUCATION (SCIENCE)

SCH 0200: INORGANIC CHEMISTRY II

DATE: 11/8/2016 **TIME: 11:00 – 1:00 PM**

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory**.
- Answer any **two** questions from section **B**.
- Find Periodic Table on the last Page.

SECTION A: COMPULSORY

QUESTION ONE

a) Define the following

i. Metallic radius (1 mark)

ii. Electropositivity (1 mark)

b) Write the electronic configuration of the following elements and indicate which block of elements they belong to

i. ^{12}Mg (2 marks)

ii. ^{34}Se (2 marks)

iii. ^{86}Rn (2 marks)

c) Using a relevant example, briefly explain

i. The importance of studying the chemistry of s and p block elements (2 marks)

ii. Thermal and electrical conductivities across a period (3 marks)

iii. What happens to the size of an atom when one or more electrons are added to the neutral atom? (3 marks)

d) State and explain the general trend as observed in the periodic table for the following

i. Atomic sizes across the period (3 marks)

ii. Atomic sizes down a particular group (3 marks)

iii. Ionization energies across a particular period (3 marks)

e) Give a reason for the following:

i. Nitrogen and oxygen have approximately the same atomic size yet oxygen has a lower 1st ionization energy (IE) than nitrogen (3 marks)

ii. The second ionization energy for group 1 elements is approximately 10 -14 times higher than their first ionization energy while group 2 elements; the second ionization energy is only about 2 times higher than the first ionization energy. (2 marks)

SECTION B: ANSWER ANY TWO (2) QUESTIONS

QUESTION TWO

a) Define the term catenation as used in inorganic chemistry (2 marks)

b) List and briefly explain four(4) factors that influence ionization energies of atoms (8 marks)

c) Complete and balance the following reactions

i. $SiCl_4 + H_2O \longrightarrow A + B$ (2 marks)

ii. $Cu + HNO_3 \longrightarrow A + B + C$ (3 marks)

d) Briefly discuss the anomalous behavior of lithium compared to other group two metals (5 marks)

QUESTION THREE

a) Diamond, graphite and silicon dioxide are all examples of giant covalent structures.

i. What does the word giant mean in this context? (2 marks)

ii. Draw a diagram or diagrams to show the arrangement of carbon atoms in a graphite crystal. (2 marks)

b) Answer the following questions by referring to the diagrams you have drawn in question 3 (a).

i. Explain why diamond is very hard, whereas graphite is so soft that it can be used in pencils or as a lubricant. (3 marks)

ii. Explain why graphite is less dense than diamond. (3 marks)

iii. Explain why, although graphite is very much softer than diamond, both substances have very high melting points. (3 marks)

iv. Explain why graphite conducts electricity whereas diamond doesn't. (3 marks)

c) Briefly explain the extraction process of sodium (4 marks)

QUESTION FOUR

a) Briefly explain for the following statements

i. PH_3 has lower boiling point than NH_3 (2 marks)

ii. Though nitrogen exhibits **+5** oxidation state, it does not form pentahalide (2 marks)

b) Explain how the following processes can be carried out

i. Laboratory preparation of oxygen (3 marks)

ii. Industrial production of sulphuric acid (3 marks)

c) Complete the following reactions

(i) $Mg_3N_2 + H_2O \longrightarrow A + B$ (2 marks)

(ii) $Ba + HCl \longrightarrow A + B$ (2 marks)

d) Kejali was given three samples labeled A, B and C containing group 16 elements. He burnt them in air and made the following observations. Sample A formed gas (D), Sample B formed solid (E) at room temperature while Sample C formed an ionic crystalline solid (F).

i. Identify the element(s) present in samples A, B and C (3 marks)

ii. What are the possible combustion products labeled D, E and F (3 marks)

QUESTION FIVE

a) Briefly explain the following statements

i. Nitrogen (N) has low catenation compared to carbon (C) (2 marks)

ii. Red phosphorus (P) is chemically less reactive compare with White P. (2 marks)

iii. Oxygen exists as diatomic molecule (O_2) whereas sulphur exists as polyatomic molecule (S_8) (2 marks)

iv. During dilution of sulphuric acid it must be added to water but water should not be added to acid. (2 marks)

v. Oxidizing ability of halogens follows this trend; $F_2 > Cl_2 > Br_2 > I_2$ (2 marks)

b) Compare the chemistry of oxygen and its heavier congeners in terms of hydrides and halides. (10 marks)

1																		18
1 **H** 1.0079	2											13	14	15	16	17	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
11 **Na** 22.990	12 **Mg** 24.305	3	4	5	6	7	8	9	10	11	12	13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.065	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.867	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.845	27 **Co** 58.933	28 **Ni** 58.693	29 **Cu** 63.546	30 **Zn** 65.409	31 **Ga** 69.723	32 **Ge** 72.64	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.798
37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57-71 *	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89-103 #	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (264)	108 **Hs** (270)	109 **Mt** (268)	110 **Ds** (281)	111 **Rg** (272)	112 **Uub** (285)	113 **Uut** (284)	114 **Uuq** (289)	115 **Uup** (288)	116 **Uuh** (291)		118 **Uuo** (294)

* Lanthanide series

57 **La** 138.91	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97

Actinide series

89 **Ac** (227)	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)