MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DIPLOMA IN EDUCATION (SCIENCE)

SCH 0200: INORGANIC CHEMISTRY II

DATE: 6/6/2017 **TIME: 8:30 – 10:30 AM**

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 (30 MARKS)

a) Define the following terms

i) Metallic radius (1 mark)

ii) Covalent radius (1 mark)

iii) Electro-positivity (1 mark)

iv) Ionization energy (2 marks)

v) Electron affinity (1 mark)

vi) Electronegativity (1 mark)

b) Briefly explain five (5) importance of studying SCH 0200, 'The Chemistry of s- and p-block elements. (5 marks)

c) Explain the following general trends in the periodic table

i) Down a particular group, atomic sizes increases (2 marks)

ii) Nitrogen and oxygen have approximately the same atomic size yet oxygen has a lower 1^{st} ionization energy (IE) than nitrogen (2 marks)

iii) Small difference in covalent radii between Si and Ge (2 marks)

iv) Electronegativity increases from left to right across the periodic table (2 marks)

d) Arrange the following elements / compounds according to increasing

i) Covalent character; KF, CsF and LiF (2 marks)

ii) Ionic sizes; Cl^-, Na^+, F^- (2 marks)

e) Briefly explain the extraction of lead from galena (4 marks)

f) Complete the following reaction;

$MgO_{(s)} + C_{(s)} \longrightarrow$ (2 marks)

SECTION B: ANSWER ANY TWO (2) QUESTIONS

QUESTION TWO (20 MARKS)

a) Write the electronic configurations of the following elements

i) Oxygen (O) (2 marks)

ii) Titanium (Ti) (2 marks)

iii) What block of elements does titanium (Ti) and oxygen (O) belong to? Explain your answer (3 marks)

b) The table below shows values for covalent radius and ionization energies (I.E) for some elements in groups 16 and 17.

Group 16	Covalent radius / Å	1^{ST} I.E kJ/mol	Group 17	Covalent radius / Å	1^{ST} I.E kJ/mol
S	1.04	1000	F	0.71	1681
Se	1.14	941	Br	1.14	1143
Te	1.37	869	At	1.45	93
Po	1.46	812			

Briefly explain

i) The reason for the trends observed in the covalent radius within each group and between the two groups (4 marks)

ii) Why the difference in covalent radius between Te and Po is smaller than that of Se and S (2 marks)

iii) Why F has the highest first (1^{st}) ionization energy (2 marks)

c) Complete the following reactions

i) $NH_4Cl + NaOH \longrightarrow$ (3 marks)

ii) $NF_3 + H_2O \longrightarrow$ (2 marks)

QUESTION THREE (20 MARKS)

a) Explain the anomalous behavior of lithium (6 marks)

b) Complete the following reactions (10 marks)

i) $Mg_3N_2 + H_2O \longrightarrow$

ii) $B_2O_3 + P_2O_5 \longrightarrow$

iii) $Fe_2O_3 + CO \longrightarrow \longrightarrow$

iv) $SiO_2 + 2C$

v) $Ba + HCl \longrightarrow$

c) A second year Chemistry Diploma student carried out an experiment on the determination of the heats of formation in kJ/mol for the following hydrides; H_2O, H_2Se and H_2Te. The results obtained were -242, +81 and +154 respectively; briefly explain the trend observed. (2 marks)

d) Explain why Cl has a higher electron affinity than F. (2 marks)

QUESTION FOUR (20 MARKS)

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 to show the arrangement of carbon atoms in a diamond crystal. (3 marks)
   (iii) Draw a diagram to show the arrangement of carbon atoms in a graphite crystal. (3 marks)

b) Answer the following questions by referring to the diagrams you have drawn in question 3 (a).
   (i) Explain the hybridization of carbon in diamond (3 marks)
   (ii) Explain why diamond is very hard, whereas graphite is so soft that it can be used in pencils or as a lubricant. (3 marks)
   (iii) The densities of diamond and graphite are: diamond 3.51 g cm^{-3}; graphite 2.25 g cm^{-3}. Explain why graphite is less dense than diamond. (2 marks)
   (iv) Explain why although graphite is very much softer than diamond, both substances have very high melting points. (2 marks)
   (v) Explain why graphite conducts electricity whereas diamond doesn't. (2 marks)

QUESTION FIVE (20 MARKS)

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

b) Describe how the following metals can be extracted from their ores:
   a. Tin from cassiterate (SnO_2) (4 marks)
   b. Phosphorous from phosphate rock (3 marks)
   c. Sodium (3 marks)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** 1.0079																	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											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)