(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

MAIN EXAMINATION

2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE
OF

BACHELOR OF SCIENCE (CHEMISTRY) AND BACHELOR OF EDUCATION SCIENCE

COURSE CODE: SCH 111

COURSE TITLE: INORGANIC CHEMISTRY

DATE: 29th April, 2022   **TIME:** 12.00 PM – 2.00 PM

INSTRUCTIONS TO CANDIDATES

Total Marks: 70

Answer all the Questions.

Therein is a graph paper.

TIME: 2 Hours

QUESTION ONE (17 Marks)

(a) State the difference between an orbit and an atomic orbital. (2 marks) .

(b) State any two properties of covalent compounds   (2 marks)

(c) Metallic compounds are good conductors of electricity. Explain   (2 marks)

(d) Use the sea of electrons model to explain why Magnesium has a higher melting point (650 °C) than sodium (97.79 °C).   (2 marks)

(e) Distinguish between electron affinity and electronegativity. (2 Marks)

(f) State and describe any two factors that affect solubility of salts. (2 marks)

.(g) Give two examples of anionic ligands, stating their respective chemical names. (2 marks).

(h) State one use of each of the following complexes. (3 marks)

   i) platinum complex

   ii) Haemoglobin

   iii) $[Ag(NH_3)_2]^+$ -tollen reagent

QUESTION TWO (19 MARKS)

(a)Explain the various types of quantum numbers   (4 marks)

(b) Write the condensed electron configuration for the following atoms and determine the number of unpaired electrons in each by filling in the energy levels. (4 marks

(i) Sulphur (S)

(ii) Potassium (K)

(c) Write the Schrodinger wave equation for Hydrogen atom and explain the physical significance of the ψ^2 (4 marks)

(d)   What are the possible values of the magnetic quantum number when the principle quantum number is 4 and the Angular momentum quantum number is 1. (2 marks)

(e) Using an example, define a bidentate ligand. (2 marks)

(f)Give the chemical name of the following compounds (3 marks)

     (a) $[Mn (CN)_6]^4$

     (b) $[Pt Cl_4]^{2-}$

     (d) $[Ag (NH_3)_2] [BF_4]$
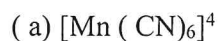
QUESTION 3 (19 marks)

  (a) With examples, define a polyatomic compound (3 marks)

  (b) State any two factors affecting the actual bond angle of a molecule.   (2 marks):

c) Although geometries of NH_3 and H_2O molecules are distorted tetrahedral, bond angle of water is less than that of ammonia. Discuss   (3mks)

(d) Using an illustration, discuss the sp^3 hybridization in a methane molecule in terms of shape and bond angle.   (5 marks)

(e) Discuss the formation of Pie(п) bonds and Sigma (σ) bond). (4 marks)

(f) Using the VSEPR model predict the shapes of the following molecules   (2marks)
   i. PF_5

  ii $SiCl_4$

QUESTIONS 4 (15 marks)

a) Define an acid and a base using Arrhenius theory   (1marks)

b) With relevant examples differentiate between the following terms in each case   (6mks)

(i) Organic acid and inorganic acid

(ii) A polar covalent bond and a nonpolar covalent bond

(iii) Hydracids and oxyacids

c) Discuss 2 factors that affect the strength of the acid by considering the acids HOCl and HOClO$_3$ (2 marks)

(d) What is the difference between iron compounds given below ? $K_4[Fe(CN)_6]$ and

$FeSO_4 .(NH_4)_2 SO_4.6H_2O$.   (2 marks)

e) Ammonia is very soluble in water. This gas is bubbled through 500 cm^3 of water to form a solution of ammonium hydroxide. The equation below represents the chemical reaction taking place.

$$NH_{3(g)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$$

i.   How would you classify ammonia in terms of Bronsted-Lowry theory? Explain   (2mks).

ii.   Identify the acid and its conjugate base for the reverse reaction   (2 marks)

Elements of the Periodic Table

1A (1)																	8A (18)
1 **H** 1.008	2A (2)											3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	2 **He** 4.003
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31	3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8)	8B (9)	8B (10)	1B (11)	2B (12)	13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 (269)	111 (272)	112 (277)						

As of mid-1999. elements 110 through 112 have not yet been named.

		58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
6	Lanthanides	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
7	Actinides	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	94 **Pu** (242)	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** (260)