JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE ENERGY, CONSTRUCTION AND MANAGEMENT AND WATER RESOURCE ENGINEERING

1^{ST} YEAR 1^{ST} SEMESTER 2018/2019 ACADEMIC YEAR

MAIN REGULAR

COURSE CODE: SCH 3111

COURSE TITLE: INORGANIC CHEMISTRY

EXAM VENUE: **STREAM: (BEd. Science)**

DATE:

TIME: **EXAM SESSION:**

INSTRUCTIONS:

1. **Answer question 1 (Compulsory) in section A and ANY other 2 questions in Section B.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**
4. **Some important information/formulas are found on the last page of this question paper**

SECTION A

Question 1

a) An increase in the principal quantum number from n = 1 to n = ∞ corresponds to the ionization of the atom and the ionization energy can be determined. Given that one mole of a substance contains $6.022 \times 10^{23} mol^{-1}$ particles, determine the first ionization energy for H. (6 marks)

b) Briefly discuss the four quantum numbers that fully describes the electronic configuration of an atom. (8 marks)

c) Describe the electronic configurations (*spdf*) of the following atoms. (8 marks)

i. Zinc (Z = 30)
ii. Chromium (Z = 24)
iii. Copper (Z = 29)
iv. Platinum (Z = 78)

d) Use the electron box and arrow configurations in combination with Pauli exclusion principle and Hund's rule to demonstrate the electronic configuration of V^{+}, V^{2+}, V^{3+}, V^{4+}, and V^{5+} (Vanadium, Z = 23) (4 marks)

e) Use the Bohr equation to determine the Bohr radius of H atom at n = 1. (4 marks)

SECTION B answer any two questions

Question 2

a) Describe the energy level diagram for the Xenone (Z = 54) and Radon (Z = 86) gases (10 marks)

b) Describe the shapes of atomic orbitals in an *s* orbital, *p* orbital and *d* orbital (10 marks)

Question 3

a) Given that the principal quantum number, n, is 3, and using the rules that govern quantum numbers *n* and *l*, write down the allowed values of *l* and m_l, and determine the number of atomic orbitals possible for n = 4.

(6 marks)

b) Confirm that the experimentally observed electronic configuration of K, $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $4s^1$, is energetically more stable than the configuration $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $3d^1$. (6 marks)

c) Briefly discuss the following principles: The aufbau principle, The Pauli exclusion principle, degenerate orbitals, and The hands rule. (8 marks)

Question 4

a) Brirfly discuss electron transitions that make up the Lyman and Balmer series in the emission spectrum of atomic hydrogen (use of a diagram is prefered). (10 marks)

b) Use the first 30 elements in the periodic table to demonstrate why they are lebelled as *s* block, *d* block, and *p* block elements. (5 marks)

c) Briefly discuss the molecular orbitals in an oxygen molecule. (5 marks)

Periodic table

Key: 1 — Atomic number, Z; H — Element symbol; 1.008 — Relative atomic mass, A_r

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H 1.008																	2 He 4.00
3 Li 6.94	4 Be 9.01											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											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.01	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.54	30 Zn 65.41	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.91	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 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30
55 Cs 132.91	56 Ba 137.34	La–Lu	72 Hf 178.49	73 Ta 180.95	74 W 183.85	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 204.37	82 Pb 207.19	83 Bi 208.98	84 Po 210	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226.03	Ac–Lr	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [277]	109 Mt [268]	110 Ds [271]	111 Rg [272]	112 Uub [285]						

Lanthanoids	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
Actinoids	89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 239.05	95 Am 241.06	96 Cm 244.07	97 Bk 249.08	98 Cf 252.08	99 Es 252.09	100 Fm 257.10	101 Md 258.10	102 No 259	103 Lr 262