KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2016/2017 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER
SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 210

COURSE TITLE: ATOMIC STRUCTURE AND CHEMICAL BONDING

DURATION: 2 HOURS

DATE: MONDAY 9TH SEPTEMBER 2017   TIME: 9 – 11AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **3** printed pages. Please Turn Over

$h = 6.626 \times 10^{-34} js$

$c = 3.0 \times 10^{8} m/s$

SECTION A

Question 1

(a) Define the term ligand giving an example.. (2)

(b) Distinguish between monodentate and polydentate ligands................. (2)

(c) Study the table below and use the information to answer the questions that follow

Element	Na	Mg	Al	Si	P	S	Cl
Atomic radius	1.90	1.60	1.43	1.32	1.28	1.27	0.98
Ionic radius	0.95	0.65	0.50	2.71	2.12	1.84	1.81
1st Ionization energy	492	743	5.79	791	1060	1003	1254

    (i)   Explain the gradual decrease of atomic radius across the period........... (2)

    (ii)   The ionic radius of Na^+, Mg^{2+} and Al^{3+} are less than the corresponding atomic radius while the ionic radius of Cl^- and S^{2-}. Explain .... (4)

    (iii)   Explain the general increase in the first ionization energy across the period...(2)

(d) Briefly explain the concept of particle wave duality of matter.......................... (2)

(e) What is the equation of De Broqlie wavelength? Define the terms............... (3)

(f) Calculate the De Broqlie's wavelength of a photon with a mass of 1.6×10^{-27} kg travelling at 40 of the speed of light.. (3)

(g) State four quantum numbers used to characterise an electron in an atom and also describe the information each give... (4)

(h) Draw all the shapes of 2p orbitals... (3)

(i) Using an equation, explain Heisenberg's uncertainityprinciple .... (2)

(j) State the significance of the following.. (3)

    (i)   Radial wave function

    (ii)   Radial distribution function

    (iii)   Angular wave function

Question 2

(a) Sketch all the 3d orbitals... (5)

(b) Explain the shielding effect of electrons... (2)

(c) List the line series in the hydrogen atomic spectrum...................................... (5)

(d) State the significance of the square of the wave function............................... (2)

(e) Draw and predict the shapes of the following molecules

    (i)   Aluminium chloride... (2)

    (ii)   Phosphorus pentafluoride.. (2)

    (iii)   Sulphur hexafluoride...(2)

Question 3

(a) Draw the molecular orbital diagrams for the following molecules and ions and each case, determine the bond order and magnetic properties.................................... (10)

   (i) O_2^{2-}

   (ii) N_2^+

(b) Sketch and describe graphs of variation of ψ and ψ^2 with the lenghth of a box X for n =1, 2,3 and 4 for a particle in one dimensional box... (8)

(c) State Hess' law... (2)

Question 4

(a) Predict and draw the molecular geometries of the molecules or ions............................... (10)

   (i) CrO_4^{2-}

   (ii) IF_6^+

   (iii) ClF_3

   (iv) H_2F^+

   (v) PF_4^-

(b) Predict the hybridization of the central atom in the molecules/ ions in (a) above...(5)

(c) The speed of a 2.5g projectile is known to be within 1.0×10^{-6} m/s. From the concept of Heisenberg's uncertainty principle, determine the minimum uncertainty in position for this particle... (5)