



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
(SCIENCE)
2ND YEAR 1ST SEMESTER 2013/2014 ACADEMIC YEAR
MAIN

COURSE CODE: SCH 3211

COURSE TITLE: INORGANIC CHEMISTRY

EXAM VENUE: LAB 3

STREAM: (SBPS)

DATE: 25/04/14

EXAM SESSION: 11.30 – 1.30 PM

TIME: 2.00 HOURS

Instructions:

- 1. Answer ALL Questions 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.**

SECTION A ATTEMPT ALL QUESTIONS

QUESTION ONE

- (a) How can the intrinsic strength of a bond be achieved by using a pure s orbital? (4 marks)
- (b) The Valence bond theory is unsatisfactory for open shell systems. Show how this statement is true? (5 marks)
- (c) Discuss the Bohr's theory of atomic spectra. Give examples to support your answer (5 marks)
- (d) Discuss the concept of the nuclear theory of the atom and show the origin of spectra in relation to the hydrogen atom. (5 marks)
- (e) Using an example of diatomic molecule in MO theory like the H_2 . Describe the elementary MO theory treatments achieved using the H_2 molecule as an example. (5 marks)
- (f) Show that Schrödinger equation is consistent with probability conservation (6 marks)

SECTION B

QUESTION TWO:

- (a) What is the orthogonality of the wave function in MO theory? (3 marks)
- (b) Define term octet rule. (4 marks)
- (c) Describe the properties of the bond energies in a covalent bond. (2 marks)
- (d) How is the strength of a covalent bond achieved? (3 marks)
- (e) The valence bond descriptions of hypervalent species can be devised by postulating hybridization of nd, ns and np orbitals. Discuss how can the above hybridization works for nd, ns and np . (8 marks)

QUESTION THREE

- (a) What are the limitations of the Bohr's theory of the atoms. (8 marks)
- b) How can the limitation in 3(a) be corrected? (5 marks)
- (C)The Schrödinger equation predicts that if certain properties of a system are measured, the result may be quantized. Taking two examples of energy quantization, describe this predictions (7 Marks)

QUESTION FOUR

(a) For the time-independent equation with two wave functions ψ_1 and ψ_2 as solutions to the equation with the same energy E , outline how the degeneracy of the two solutions can be achieved? 7 Marks

(b) What are the weaknesses of the Bohr – Sommerfeld theory? (7 marks)

(c) Name the four strategic points that can give the polyatomic ion the right to exist according to the valence bond theory . (6 marks)

QUESTION FIVE:

(a) Take an example of heteronuclear diatomic compound such as hydrogen fluoride (HF). Describe the MO treatments of the orbital bonding. (8 marks)

(b) What is Hund's rule (3 marks)

(c) Write brief notes on each of the following quantum mechanics terms

(i) Emission and absorption spectra (3 marks)

(ii) Pauli exclusion principle (3 marks)

(iii) Excitation of spectra (3 marks)