JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION 2012/2013

1ST YEAR 1ST SEMESTER EXAMINATION FOR BACHELORS DEGREE
(REGULAR)

COURSE CODE: SCH 102/3112

TITLE: BASIC INORGANIC CHEMISTRY

DATE: 29/4/2013 TIME: 14.00-16.00PM

DURATION: 2 HOURS

INSTRUCTIONS

1. Answer ALL questions in Section A
2. Answer ANY two Questions from Section B
3. Use illustrations where possible

Useful information

1 Faraday = 96500 coulombs
Volume of molar mass of gas at s.t.p =22.4 dm^3 = 22400 cm^3
Gas constant =0.082 L atm K^{-1} mol^{-1}= 8.314 J $K^{-1}$$mol^{-1}$

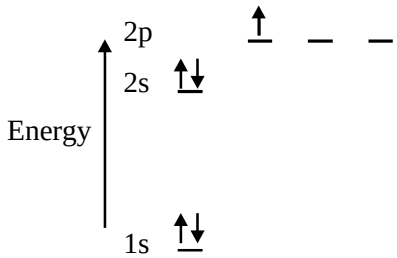
Section A This section contains ONE COMPULSORY question

QUESTION 1 (Compulsory -30 marks)

1) a) By giving appropriate examples where necessary, briefly explain each of the following terms: (14 marks)

i. Quantization of energy
ii. Radioactive decay
iii. Duality of matter
iv. Aufbau's rule
v. Shielding factor
vi. Lanthanide contraction
vii. Pauli's exclusion principle

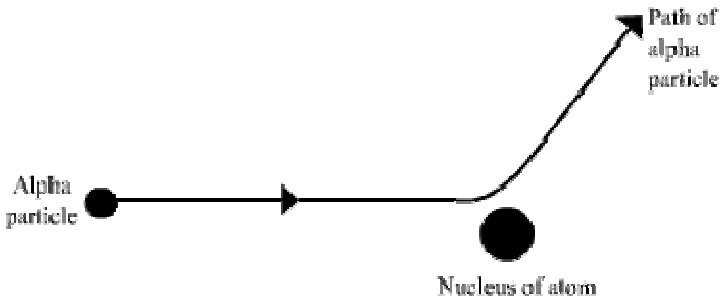
b) The diagram below shows the electronic structure of boron.



i. The electrons are represented by arrows. What property of the electrons do these 'up' and 'down' arrows represent? (1 mark)

ii. Suggest reason(s) why electrons which occupy the 2p sub-levels have a higher energy than electrons in the 2s sub-level (2 marks)

c). A new model of an atom was suggested by Rutherford and Marsden. They fired alpha particles at thin metal foil. Alpha particles are positively charged. In their model each atom has a nucleus. The diagram below shows the path of an alpha particle as it passes the nucleus of an atom.



i. Explain why the alpha particle changes direction. (2 marks)

ii. What was the main significance of this experiment in the development of the modern understanding of the atomic structure? (1 mark)

iii. Carbon-14 is unstable and for a period of time it decomposes to for nitrogen-14. Write equation to show this reaction. (3 marks)

d). Calculate:

i) The effective nuclear charge for one of the parent electrons in potassium (4 marks)

ii) Spin only magnetic moments in nitrogen atom (3 marks)

Section B: This section contains FOUR questions. Answer ONLY TWO questions.

QUESTION TWO (Optional, 20 marks)

a) Briefly discuss production of cathode rays (5 marks)

b) Using appropriate examples where necessary, outline the properties of cathode rays (10 marks)

c) Outline J.J. Thomson's experiment to measure the charge/mass ratio of an electron. (5 marks)

QUESTION THREE (Optional, 20 marks)

(a) Deduce an expression in terms of the wavelength of radiation absorbed for change in energy when an electron moves from n_1 energy level to n_2 energy level (4 marks)

(b) What is the wavelength of radiation when a hydrogen electron moves from n_3 to n_4 (3 marks)

(c) A radio operator broadcasts at a frequency of 14.2 MHz. Calculate the wavelength of the transmissions (3 marks)

(d) What is the wavelength of a grain of sand whose mass is 0.00011 g moving at a speed of 0.01 m/s (3 marks)

(e) Determine the wavelength in nanometres of green light having a frequency of 6.67×10^{14} m/s (4 marks)

QUESTION FOUR (Optional, 20 marks)

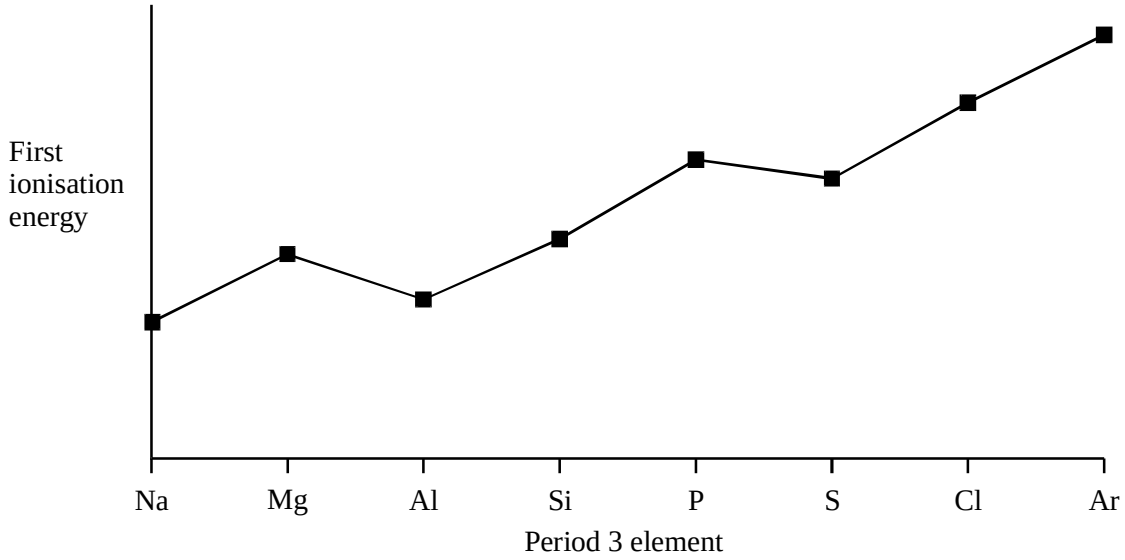
(a) Sketch the shapes of each of the following orbitals (8 marks)

i. p_z
ii. dxy
iii. dx^2-y^2
iv. dz^2

(b) Write the electronic configuration of each of the following elements and in each case calculate the spin only magnetic moments and the screening factor for one of the parent electrons (8 marks)

i. atomic number 59
ii. atomic number 50

(c) The diagram below shows the variation in first ionisation energy across Period 3.



Suggest reason(s) whys the ionization energy of phosphorus (15) is greater than that of sulphur (16) and that of magnessium (24) is great than that of aluminium (27) (4 marks)

QUESTION FIVE (Optional, 20 marks)

(a) Briefly explain the factors that influence formation of ionic bonds. (4 marks)

(b) The following data relate to the ionic structure of lithium fluoride:

Type of energy	**Quantity**
Vaporization of lithium metal	+37.1
Ionization energy of lithium atoms	+124.3
Dissociation of fluoride molecules	+18.9
Electron affinity of fluorine	-78.4
Lattice energy of lithium fluoride	+242.8

Calculate the energy of stabilization (3 marks)

(c) Work out and sketch the Lewis structures for each of the following compounds: (8 marks)

a. ICl_4
b. SO_2

(d) Briefly outline the properties of covalent compounds. (5 marks)

END