KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER
SUPLEMETARY EXAMINATIONS

FOR THE DEGREE OF B.SC AND B.ED (SCIENCE)

COURSE CODE: SCH 100

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY I

DURATION: 2 HOURS

DATE: 08/10/2018   **TIME: 11:30-1:30PM**

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.

Some physical constants

Plank's constant= 6.626×10^{-34} Js
Charge of an electron = 1.602×10^{-19} C
Speed of light in a vacuum = 3.0×10^8 m/s
Charge to mass ratio (e/m) = -1.76×10^8 C/g
Rydberg constant = 109676 cm^{-1} OR 2.179×10^{-18} J

This paper consists of **4** printed pages. Please Turn Over ▶

KIBU observes ZERO tolerance to examination cheating

Question 1(30 marks)

a) State or definethe following terms;   **(5 marks)**
    i.   Ionization energy
    ii.   Electron affinity
    iii. Pauli's exclusive principle
    iv. Aufbau principle
    v.   Hund's rule

b) Draw the structures of the following compounds.   **(4 marks)**

i. 3-methyl-3-heptene   ii. 6-bromo-4-ethyl-2-heptanol

iii. 4-methyl-2-hexyne   iv. 1,3-dimethylcyclohexane

c) Write the possible structural formulas for the following compounds and name the functional group in each case.   **(3 Marks)**

i. CH_4O ii. CH_2O_2 iii. CH_5N

d). State any four properties of cathode rays.   **(4 Marks)**e)

i.The simplified relation expressing the amount of energy possessed by an electron

    in a given energy level is;
$$E_n = -R/n^2$$
How much energy would be needed to make an electron move from the an initial energy level, n= 2 to another energy level of n= 3   **(3 marks)**

ii. If this energy is emitted inform of light, what is its wavenumber (h=6.6262 x 10^{-34}Js,

iii.Explain why salts of Zn^{2+} are colourless while those of Cu^{2+} are coloured   **(3 marks)**

f) Calculate the wavelength in cm of the Balmer Series where n=4.   **(2 marks)**

g) With regard to CO_3^{2-}, explain the concept of resonance   **(3 marks)**
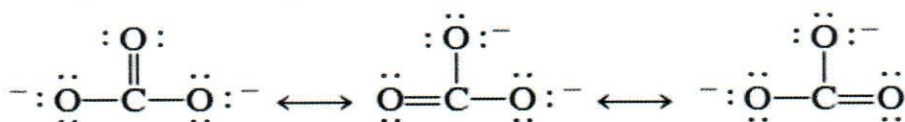
Question 2 (20 marks)

a) Give two failures of the Rutherford model of the atom.   **(2 marks)**

b) Give the observations recorded by J. J. Thompson in his cathode ray experiment. Explain the observations.   **(4 marks)**

c) Give three shortcomings of the Bohr model of the atom.   **(3 marks)**

d) State three rules governing building up process for many electron atoms.   **(3 marks)**

e) What does the magnetic quantum number specifies? **(2 marks)**

f) What are the possible values for the spin quantum number? **(1 mark)**

g) Draw a diagram to illustrate the hydrogen atom spectral series. **(5 marks)**

Question 3 (20 marks)

a) Sketch the shapes of the 2p orbitals **(3 marks)**

b) Arrange the following in the order of increasing first ionization potential B, Ne, N, O. Explain **(2 marks)**

c) Write the electronic configuration for these atomic numbers; 6, 19, 29, 54. **(4 marks)**

d) List the five spectral series in the atomic spectrum of hydrogen and the regions they occur. **(5 Marks)**

e) State the characteristics of a waves **(4 marks)**

f) Differentiate between covalent and ionic bonds **(2 Marks)**

Question 4 (20 marks)

a) Explain how and why the following properties of the elements will change in a givengroup or period **(3 marks)**

    i. Atomic radius across period two elements

    ii. Electron affinity across a given period

    iii. Metallic character down group VA

b) Explain the following observations;

    i. Ionic compounds are usually solids with high melting points while covalent compounds are not **(2 marks)**

    ii. Electrical conductivity of metals decreases with increasing temperature when the metal is heated **(1 mark)**

    iii. Lithium and magnesium have similar characteristics even though they are in different groups. **(1 mark)**

    iv. The ionization potential of beryllium is much larger than that of boron though boron is slightly larger in size than beryllium **(1 mark)**

c)A meteorite found in central Indiana contains traces of noble gas neon that appear to have been picked up from the solar wind as the meteorite traversed the solar system before it fell. A mass spectrum of the gas showed that it consisted of 91.84% ^{20}Ne (mass 19.9924 amu), 0.47% ^{21}Ne (mass 20.9940 amu), and 7.69% ^{22}Ne (mass 21.9914 amu). What is the average mass of the neon in the solar wind? **(2 marks)**

d) What volume of 1.59 M KOH is required to prepare 5.0L of 0.1M KOH?   **(1 mark)**

e) The reaction of an α particle with magnesium 25 ($^{25}_{12}Mg$) produces a proton ^1_1H and a nuclide of another element. Identify the new nuclide.   **(2 marks)**

f) i. Explain the factors affecting formation of ionic bond   **(6 marks)**

   ii. Give any two characteristic of covalent bond.   **(1 mark)**