



MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.

Tel: 020-2069349, 061-2309217. 064-30320 Cell phone: +254 712524293, +254 789151411

Fax: 064-30321

Website: www.must.ac.ke Email: info@mucst.ac.ke

University Examinations 2012/2013

FIRSTYEAR, SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF
BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE

SCH 2110: CHEMISTRY

DATE: APRIL 2013

TIME: 2 HOURS

INSTRUCTIONS: Answer question *one* and any other *two* questions

The following physical constants may be useful

Avogadro's number (N_A)	= 6.023×10^{23}
Rydberg's constant, R_H	= $1.097 \times 10^7 m^{-1}$
Planck's constant, h	= $6.63 \times 10^{-34} Js$
Charge of an electron	= $1.602 \times 10^{-19} Coulombs$
Permittivity of free space ϵ_0	= $8.85 \times 10^{-12} C^3/Nm^2$
Velocity of light in vacuum	= $2.99 \times 10^8 ms^{-1}$
π	= 3.142

QUESTION ONE (30 MARKS)

- Draw a sketch showing the various parts of hydrogen line spectrum. (4 Marks)
 - Give uses each of gamma rays, x – rays and infrared parts of an electromagnetic radiation. (4 Marks)
- Define the following terms; (6 Marks)
 - Nucleons
 - Isotopes
 - Wave number
- Give the isotopes of the element, Hydrogen. (3 Marks)
 - Using inert gas core, write electronic configurations of Phosphorous (15), Chromium (24). (4 Marks)
- Use relevant examples to explain the statement “dual nature of matter”. (6 Marks)
- Calculate the energy of a photon whose wavelength is 580nm. (3 Marks)

QUESTION TWO (20 MARKS)

- a) The atomic number for the elements; Lithium, Fluorine, Chromium, Strontium and tellurium are 3, 9, 24, 38 and 52 respectively.
- Write the electronic configuration for each element. (5 Marks)
 - Briefly discuss the group in which each of the elements belong. (5 Marks)
- b) Explain why;
- Atomic radii of group IA element is the largest in any given period. (3 Marks)
 - Atomic radii decrease generally across any given period. (3 Marks)
 - Electron affinities of group VII A elements are larger than for group IA. (4 Marks)

QUESTION THREE (20 MARKS)

- a) In an experiment, 25.0ml of 0.1M HCl are titrated against 0.1M NaOH. Sketch the pH profile for the titration (titration curve) of HCl with the 0.1M NaOH as the base. Indicate the neutralization point of the reaction. (6 Marks)
- b) 10.0ml of NaOH is added to 25.0ml of 0.10M CH₃COOH.
- Write an equation for the reaction between NaOH and CH₃COOH. (2 Marks)
 - Determine the mole ratio for the reacting substances. (2 Marks)
 - How many moles of CH₃COOH react with 10.0ml of 0.10M NaOH? (4 Marks)
 - Calculate the pH of the buffer system established after the addition of 10.0ml of NaOH to the acid solution. (6 Marks)

QUESTION FOUR (20 MARKS)

- a) Define the following in terms of electrons. (4 Marks)
- Oxidation agent
 - Half-reaction
- b) Assign oxidation numbers to all elements in the following ions. (4 Marks)
- MnO₄⁻
 - ClO₃⁻
- c) When metallic zinc granules are added to a solution of copper(II) sulphate, the blue colour of copper(II) sulphate is discharged.
- Why is the blue colour of copper (II) sulphate discharged? (2 Marks)
 - Write half – reactions for each of the reactants. (4 Marks)
 - Write the overall equation for the reaction. (2 Marks)
- d) The standard reduction potentials of Cl₂, Br₂ and I₂ are shown
- $$\text{Cl}_{2(1\text{ atm})} + 2e^{-} \rightarrow 2\text{Cl}^{-} \quad E^0 = +1.36\text{V}$$
- $$\text{Br}_{2(1\text{ atm})} + 2e^{-} \rightarrow 2\text{Br}^{-} \quad E^0 = +1.07\text{V}$$
- $$\text{I}_{2(s)} + 2e^{-} \rightarrow 2\text{I}^{-} \quad E^0 = +0.53\text{V}$$
- Bromine is added to a solution containing NaCl and NaI at 25°C. Assuming all the species are in their standard states, use the information provided to identify the halogen species that will be oxidized during this interaction. (4 Marks)