Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN
BUIDLING & CIVIL, ELECTRICAL AND ELECTRONICS ENGINEERING AND MCHANICAL & AUTOMOTIVE ENGINEERING

SCH 2101 : CHEMISTRY I

SPECIAL/SUPPLEMENTARY EXAMINATION

FEBRUARY 2013 SERIES
2 HOURS
Instructions to candidates:

This paper consist of **FIVE** questions
Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

   (i)   Define an orbital of electrons

          (1mark)

   (ii)   Discuss briefly the formation for chemical bond in terms of orbital theory.

          (6marks)

   (iii)   State the following principles and rules as used in electron distribution

     (a) Pauli'sexclusion principle

     (b) Hund's Rule

     (c) Aufbau principle   **(6marks)**

   (iv)   Draw the shape of the following orbitals

     (a) $2P_z$, (b)$1S$ (c) d_z^2 (d) dx^2y^2

          (4marks)

   (v)   Calculate the lattice energy of KCl from the following data (please show all the steps)

(10marks)

(a) Enthalpy of sublimation of potassium   = $90.9 KJmol^{-1}$

(b) Ionization energy of potassium   = $418.7 KJmol^{-1}$

(c) Enthalpy of dissociation of chlorine   = $240 KJmol^{-1}$

(d) Electron affinity of chlorine   = $-348.7 KJ \ mol^{-1}$

(e) Enthalpy of formation of KCl   = $-440.3 KJ \ mol^{-1}$

(f) Briefly discuss the formation of metallic bonds.   **(3marks)**

Question TWO

i)   Define the following terms as used in kinematics

(a) Molecularity

(b) Order of the reaction

(c) Reaction Rate

(d) Complex reaction

         (4marks)

ii)   Outline factors which influence Rate of reaction   **(5marks)**

iii)   Define farcical life period or Half life period as used in kinematics

         (2marks)

iv)   The half-life period of a reaction of the first order is 300s. Calculate its rate constant in seconds and minutes.   **(3marks)**

v)   The rate constant of a zero order reaction is $0.2 moldm^{-3}h^{-1}$. What will be the initial concentration of the reactant if, after half an hour, its concentration is $0.05 mol \ dm^{-3}$?

         (6marks)

Question THREE

i)   Define equilibrium constant.

         (1mark)

ii)   Show the relationship between the equilibrium constant and solubility product.   **(3marks)**

iii) The solubility of CaF_2 (molar mass = 78) in water is $1.6 \times 10^{-2}g \ l^{-1}$ at 20°C. Calculate the solubility product of CaF_2.   **(6marks)**

iv) Predict whether there will be any precipitation on mixing 50ml of 0.001M NaCl solution

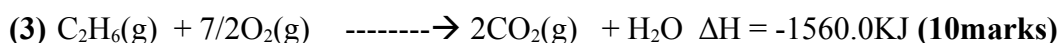with 50ml of 0.01m Ag No3 solution. Ksp(AgCl) = 1.5 x 10^{-10} **(10marks)**

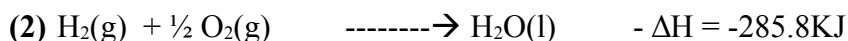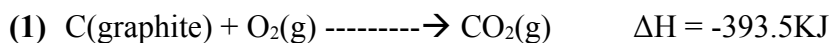**Question FOUR**

i) State HESS'S Law

    (1mark)

ii) Calculate the enthalpy of the reaction 2C (Graphite) + 3H$_2$(g) -----------→ C$_2$H$_6$ (g)

Given that

(1) C(graphite) + O$_2$(g) ---------→ CO$_2$(g)   ΔH = -393.5KJ

(2) H$_2$(g) + ½ O$_2$(g)   --------→ H$_2$O(l)   - ΔH = -285.8KJ

(3) C$_2$H$_6$(g) + 7/2O$_2$(g)   --------→ 2CO$_2$(g) + H$_2$O   ΔH = -1560.0KJ **(10marks)**

iii) The enthalpy of solution of anhydrous CuCO$_4$ and CuCO$_4$ 5H$_2$O ar -15.89 and 2.80 Kcal respectively. Calculate the enthalpy of hydration of CuSO$_4$ to CuSO$_4$ 5H$_2$O **(9marks)**

Question FIVE

i) Describe Rutherford nuclear model of the atom.   **(6marks)**

ii) Define the following

    a) Wavelength

    b) Wave number

    c) Frequency

    d) Amplitude

    (4marks)

iii) The wavelength of blue light is 480nm. Calculate the frequency and wave number of this light (C = (3 x 10^{8}ms))   **(5marks)**

iv) Write down electrons configuration for the following elements.

    a) Ti(Z =22)   (b)   Sc (Z =21)   (c)   Cr (Z =24)   (d)   Cu(Z =29)

    e)   K (Z) = 19

    (5marks)