CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

RESIT/SPECIAL EXAMINATION

EXAMINATION FOR THE AWARD OF DEGREE
OF BACHELOR OF SCIENCE

CHEM 120: PHYSICAL CHEMISTRY I

STREAMS: BSC   **TIME: 2 HOURS**

DAY/DATE: MONDAY 16/11/2020   **8.30 A.M. – 10.30 A.M.**

INSTRUCTIONS: Answer ALL Questions.

QUESTION ONE (30 MARKS)

1a.   (i) State Faraday's first and second law of electrolysis   (2 marks)

(ii) Explain the significance of Faraday law of Electrolysis   (4 marks)

(iii) Three cells containing respectively solutions of silver nitrate, copper (II) sulphate
and dilute sulphuric acid are fitted with platinum electrodes and placed in series. An
electric current of 2.5 amperes is passed through the cells when 0.4g of silver was
deposited in the first cell. Calculate:

   (i)   The weight of copper deposited in the second cell   (3 marks)

   (ii)   The length of time the current was passed   (2 marks)

            (T=1, Cu =63.6, Ag =108, 1F =96500 Coulombs)

   (iii)   The volume of hydrogen liberated at $17^{\circ}C$ and 770mmHg in the third cell

                                                                          (6 marks)

b)   Selenium in a 10.0g soil sample is distilled as the tetrabromide, which is collected in
aqueous solution where it is hydrolyzed to SeO_3^{2-}. The SeO_3^{2-} is determined
iodometrically requiring 4.5ml of standard thiosulphate solution for the titration. If the
thiosulphate titer is 0.049mg k_2Cr_2O7/ml. Calculate the concentration of selenium in the
soil in ppm. (Se = 78.96, O = 15.9994, K = 39.098, Cr = 51.996 and I= 126.9045)

                                                                          (13 marks)

QUESTION TWO (20 marks)

2 (a) Distinguish between reversible cell and irreversible cell   (8 marks)

  (b) (i) State Hess's law   (1 mark)

     (ii) Use Hess's law to calculate the following enthalpy of reaction of the major

      process of steam reforming

      $CH_{4\,(g)} + H_2O_{(g)} \rightleftharpoons CO_{(g)} + 3H_{2\,(g)}$
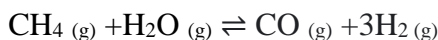
     Given- the separate reactions of carbon dioxide and hydrogen gas and methane

     decomposition

     $CO_{(g)} + H_2\,(g) \longrightarrow$ graphite $+ H_2O\,(g)$ $\Delta H = -131.3kJ$

     Graphite $(g) + 2H_2\,(g) \longrightarrow CH_4\,(g)$ $\Delta H = -74.8kJ$

(c) Discuss the various kinds of the information which can be obtained from equilibrium constant

                           (2 marks)

QUESTION THREE (20 MARKS)

3a. (i) Explain how you can characterize the deviation from ideally of a real gas

                           (6 marks)

  (ii) Two separate bulbs are filled with an ideal gas A and a non- ideal gas B

     respectively in such a way that PV remains the same and B is below its Boyle

     temperature. Show mathematically that B has greater temperature than A.

                           (4 marks)

  (iii) 0.540gm of an organic liquid displaces $71.52cm^3$ of dry air at 99.80^OC. The

     barometer pressure was 691.4 mm of Hg. The compound is saturated and contains

     only carbon, fluorine and chlorine. There is 57% Cl_2 by weight. Determine its

     molecular formula. (Cl $=35.5$, C$=12$, F$=19$)   (8 marks)

 (b) State Arrhenius equation and explain the terms involved   (2 marks)