

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2015/2016**

**THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE**

**DEGREE OF BACHELOR OF SCIENCE**

 **SCH 2314: INDUSTRIAL ELECTROCHEMISTRY**

**DATE: DECEMBER 2015 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**

**USEFUL INFORMATION**

In x = 2.203 log x

R = 8.314 Jmol-1K-1

 = 1.987 cal mol-1K-1

O0C = 273K

1F = 96500 coulombs

1 atm = 101,325 NM2

 = 760 mmHg

**QUESTION ONE (30 MARKS)**

1. List the factors that affect conductance. [4 marks]
2. The conductivity of a saturated solution of a sparingly soluble salt

MX in water at 298K is 1.887 x 10-4 SM-1. The molar conductivity

of MX at infinite dilution at this temperature is 138.3 x 10-4 SM2 mol-1. Calculate the solubility and solubility product of MX at this

temperature. [5 marks]

1. The resistance of a 0.02 mol dm-3 solution of acetic acid is a cell

(cell constant = 0.2063 cm-1) was found to be 888 . What is the

degree of ionization of the acid at this concentration?

(Given  for acetic acid = 387.9 x 10-4 S mol-1 m2). [5 marks]

1. Given the following standard reduction potentials

Sn4+ + 2  Sn2+ E0 = 0.13V

Ag+ +   Ag E0 = 0.80V

1. Calculate the potential of the cell

Pt/Sn2+ (1.0M), Sn4+ (1.0M) //Ag+ (1.0M/Ag). [2 marks]

1. Write equations for both half-cell reactions and the

overall cell reaction. [3 marks]

1. Calculate the value of G0 for the reaction. [2 marks]
2. In what way would an increase in the concentration of silver

ion affect the potential of the cell. [1 mark]

1. i) What desirable features are characteristics of a lead storage

 battery? [2 marks]

ii) What undesirable features, if any, are characteristics of a lead

 storage battery? [2 marks]

1. The reversible reduction potential of pure water is -0.414 V

under 1.00 atm H2 pressure. If the reduction is considered to

be 2H+ + 2  H2, calculate the hydrogen ion concentration

of pure water. [4 marks]

**QUESTION TWO (20 MARKS)**

1. What are the factors that govern degree of dissociation of

an electrolyte. [4 marks]

1. A base has a dissociation constant equal to 1.8 x 10-5 at 298K.

Calculate its degree of disassociation at a concentration of 0.1N

at the same temperature. [5 marks]

1. i) Discuss the applications of kohrausch law. [3 marks]

ii) At 291K the molar conductivities at infinite dilution of NH4 cl,

 NaoH and Nacl are 129.8, 217.4 and 108.9 ohm-1 cm2 respectively.

 If the molar conductivity of a centi normal solution of NH4 OH

 is 9.33 ohm-1 cm2, what is the percentage dissociation of NH4 OH

 at this dilution. [5 marks]

1. Explain concisely why a porous plate or salt bridge is not required

 in a lead storage cell. [3 marks]

**QUESTION THREE (20 MARKS)**

1. i) Discuss Faraday’s Laws of Electrolysis. [4 marks]

ii) Three electrolytic cells A, B and C containing electrolytes

 zinc sulphate, silver nitrate and copper sulphate respectively

 were connected in series. A stead y current of 1.5o ampere

 was passed through them until 1.45g f Ag were deposited at

 the cathode of cell B. [Note: Ag = 108 cu = 63.5 Zn = 65]

 a) How long did the current flow [3 marks]

 b) What weight of copper and of zinc were deposited. [6 marks]

1. i) What are the different types of reversible electrodes. [3 marks]

ii) Write down the reactions taking place separately at the two

 electrodes and the complete cell reaction

 pt, H2(g) | HCl (aq) |HCl (aq), AgCl(s) | Ag [4 marks]

1. Can a solution of 1 M copper sulphate be stored in a vessel

made of mickel metal? Explain. [3 marks]

Given that E0Ni, Ni2+ = 0.25V

 E0Cu, Cu2+ = 0.34V

**QUESTION FOUR (20 MARKS)**

1. Following table gives pH values obtained for the titration of

10.0cm3 HCl vs NaoH

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Vol. of NaoH added | 0.0 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 | 11.0 |
| pH | 2.0 | 2.3 | 2.5 | 2.8 | 3.0 | 3.3 | 3.5 | 3.8 | 4.0 | 4.3 | 7.0 | 8.7 |

Plot the graph of pH as a function of volume of NaoH added

and determine the equivalence point for the titration using

 graphical method. [10 marks]

1. i) What is meant by corrosion? [1 mark]

ii) Discuss different types of corrosion [5 marks]

iii) Describe different methods of prevention of corrosion. [4 marks]