EASTERN UNIVERSITY, SRI LANKA

FIRST SEMESTER FIRST EXAMINATION IN SCIENCE

2009/2010 (JUNE – JULY 2011)

CH 102: INTRODUCTION TO ELECTROCHEMISTRY AND THERMODYNAMICS

(Proper & Repeat)

Answer all questions Time Allowed: One hour

R = 8.314 J mol^{-1} K^{-1} 2.303 RT/F = 0.0591 V

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1) a) Define the following terms

i) Closed system ii) Reversible process

(10 marks)

b) A sample consisting of 1.00 mol Ar (behave as ideal) is expanded isothermally at 0° C from 22.4 to 44.8 L. Calculate *q*, *w*, ΔU & ΔH for the following three process (i) Reversibly (ii) against a constant external pressure equal to the final pressure of the gas (iii) freely.

(30 marks)

c) i) Define the term heat capacity and from the basic thermodynamic relations show that the isobaric heat capacity (C_p) is given by $C_p = \left(\frac{\partial H}{\partial T}\right)_p$

(20 marks)

ii) What is the change in molar enthalpy of N_2 *(g)* when it is heated from 25°C to 100° C. The molar isobaric heat capacity C_p for N_2 *(g)* over the range 25°C to 100° C is given by $C_p = a + bT + c/T^2$, where a = 28.58, b = 3.77 x 10^{-3} K^{-1} and c = -0.50 x 10^5 K^2

(40 marks)

2) a) Using the Maxwell relation $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$ Calculate the change in entropy (ΔS) of 3 moles of N_2 (g) is compressed isothermally from 5 to 10 atm. at 300k assuming that N_2 (g) obeys

(A) The ideal gas law
(B) The van der Waals equation

(30 marks)

b) For the following cell

$Pt / H_2(0.75atm) / HCl(0.25M) // Sn^{2+}(1.50M), Sn^{4+}(0.06M) / Pt$

i) Write the half – cell, cell reactions of the given cell
ii) Determine E^θ and E of the cell
iii) Calculate the ratio of concentrations of tin (II) to tin (IV) which causes the cell potential to be zero.
[$E^\theta_{Sn^{4+},Sn^{2+}} = -0.13V$]

(50 marks)

c) Is it possible to store a solution of 1 M $CuSO_4$ in a vessel made by Ni metal?

$E^\theta_{Cu^{2+},Cu} = 0.34V$ $\quad E^\theta_{Ni^{2+},Ni} = -0.25V$

(20 marks)

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