



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

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

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  $0^\circ \text{C}$  from 22.4 to 44.8 L. Calculate  $q$ ,  $w$ ,  $\Delta U$  &  $\Delta H$  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  $25^\circ \text{C}$  to  $100^\circ \text{C}$ . The molar isobaric heat capacity  $C_p$  for  $N_2(g)$  over the range  $25^\circ \text{C}$  to  $100^\circ \text{C}$  is given by  $C_p = a + bT + c/T^2$ , where  $a = 28.58$ ,  $b = 3.77 \times 10^{-3} \text{ K}^{-1}$  and  $c = -0.50 \times 10^5 \text{ K}^2$

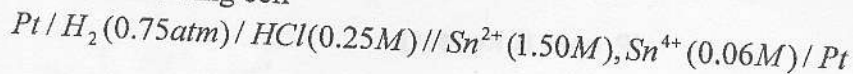
(40 marks)

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 ( $\Delta S$ ) 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



- i) Write the half – cell, cell reactions of the given cell
- ii) Determine  $E^\theta$  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.

$$[ E_{Sn^{4+}, Sn^{2+}}^\theta = -0.13V ]$$

(50 marks)

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

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

(20 marks)

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