EASTERN UNIVERSITY SRI LANKA
FIRST EXAMINATION IN SCIENCE
FIRST SEMESTER- 2003/2004 (Proper)
CH102 THERMODYNAMICS AND INTRODUCTION TO ELECTROCHEMISTRY

Answer all Questions **Time: 01 hour**

1. From the 1st and 2nd laws of Thermodynamics derive the following:

(a) i) $dA = -PdV - S\,dT$
ii) $dG = VdP - S\,dT$
iii) $dH = TdS + VdP$

(b) Using the Maxwell relation $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$, derive the thermodynamic equation of state $\left(\frac{\partial U}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V - P$ and show that for a gas (1 mole), obeying the van der Waals equation of state, $\left(\frac{\partial U}{\partial V}\right)_T = \frac{a}{V^2}$ where U is the molar internal energy and a is the van der Waals constant. Calculate the value $\left(\frac{\partial U}{\partial V}\right)_T$ for a sample of 12 dm^3 of N_2 gas at 300K given that $a = 0.121\ Jm^3mol^{-2}$.

2. (a) Standard electrode potential values of three reactions are given as follows:

$Fe^{3+} + e \longrightarrow Fe^{2+}$ $\quad E^0 = 0.76$ V

$Cl_2 + 2e \longrightarrow 2Cl^-$ $\quad E^0 = 1.26$ V

$ClO_4^- + 2H^+ + 2e \longrightarrow ClO_3^- + H_2O$ $\quad E^0 = 1.2$ V

(i) Find out if Cl_2 can oxidize Fe^{2+}.

(ii) Find out the E^0 value for the reaction between ClO_4^- and Fe^{2+}.

(b) Two moles of hydrogen gas (γ for hydrogen is 1.41) is compressed adiabatically from N.T.P. conditions to occupy a volume of 4.48 litres. Calculate the final pressure and temperature.

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