



EASTERN UNIVERSITY SRI LANKA
FIRST EXAMINATION IN SCIENCE
FIRST SEMESTER- 2003/2004 (Repeat)
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) $dH = TdS + VdP$

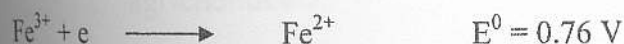
(b) Using the Maxwell relation $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$, derive the thermodynamic equation

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 dm³ of N₂ gas at 300K given that $a = 0.121 \text{ Jm}^3\text{mol}^{-2}$.

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



Predict if the reaction $\text{Fe}^{2+} + \frac{1}{2} \text{Cl}_2 \longrightarrow \text{Fe}^{3+} + \text{Cl}^-$ is feasible.

(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.
