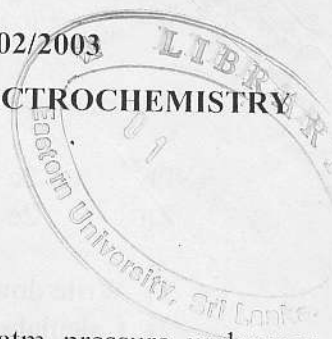


EASTERN UNIVERSITY, SRILANKA

FIRST YEAR IN SCIENCE FIRST SEMESTER 2002/2003

CH 102 THERMODYNAMICS AND INTRODUCTION TO ELECTROCHEMISTRY



Time: 01 Hour.

Answer all questions

- 1. (a) 3.0 mole of an ideal monoatomic gas at 300 K and 6 atm pressure undergoes expansion adiabatically and irreversibly to half the initial pressure against an external pressure of 3 atm. Calculate the following.
 - (1) The heat absorbed (q)
 - (2) The work done by the system (w) and
 - (3) The change in internal energy (ΔU) for the process at constant volume.

- (b) O_2 gas obeys the equation of state $(P + n^2 a / V^2) (V + nb) = nRT$
Where $a = 1.36 \text{ l}^2 \text{ atm mol}^{-2}$ and $b=0$.

Suppose two moles of $O_2(g)$ expands reversibly and isothermally at 300 K from an initial volume of 1.0 l to a final volume of 10.0 l. Calculate the work done by the gas and compare it with the work done if the above gas behaved ideally.

- 2. (a) Derive the Clapeyron equation, $dP/dT = (\Delta H_m) / (T \Delta V_m)$ for a phase transition where ΔV_m is the change in molar volume.

If the molar volumes of liquid water and steam at 100^0C and 1 atm. are 0.019 and 30.20 dm^3 respectively, what is the change in the boiling point of water due to a change in pressure by 10 mmHg?

(The latent heat of vapourisation (ΔH_m) of water is $40.65 \text{ kJ mol}^{-1}$. Assume that there are no changes in molar volumes of liquid water and steam due to a change in pressure by 10 mmHg)

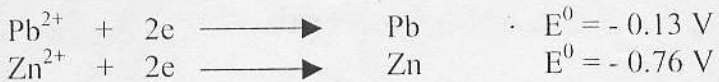
- (b) n moles of an ideal gas at temperature T_1 and volume V_1 undergo a reversible isothermal expansion to a final volume V_2 . Derive an expression for the change in entropy (ΔS) in the above process.

If 0.012 mol of the above gas is expanded reversibly and isothermally at 298 K from 40 ml to 100 ml, calculate the change in entropy (ΔS) for the process. ($1 \text{ Pa} = 1 \text{ J m}^{-3}$, $1 \text{ atm} = 1.01325 \times 10^5 \text{ Pa}$)

(c) Write down the Nernst equation for the following redox reaction



The standard electrode potentials of the following reactions are given below



- 1) Write down the total cell reaction
- 2) Calculate the E^0_{cell}
- 3) Calculate the E_{cell} of the following cell

