EASTERN UNIVERSITY, SRI LANKA
FIRST EXAMINATION IN SCIENCE - EXTERNAL DEGREE
1998/99 (Term System) Re-Repeat
June - 2008
EXCH 101 PERIODICITY & BONDING AND THERMODYNAMICS.

TIME: 2 HOURS

ANSWER FOUR QUESTIONS ONLY, SELECTING AT LEAST ONE QUESTION FROM PART B

PART A

1) Write short notes on the following

(a) Metallic bonding
(b) Polarization of ions
(c) Quantum numbers

2) (a) Draw the molecular orbital energy level diagram for CO and O_2.

(b) Place the species O_2, O_2^- and O_2^{2-} in order of increasing bond length and increasing bond energy giving reasons and indicate their magnetic property.

(c) Use molecular orbital theory to explain why the bond strength is a N_2 molecule is greater than that in a F_2 molecule.

3) (a) Explain the following statement.

'Hydrogen atom has only a single electron. However the emission spectrum of hydrogen consists of many lines.'

(b) The Balmer series of spectral lines for hydrogen appear in the visible region. What transitions correspond to the spectral lines at 379.0?
($h = 6.626 \times 10^{-34}$ Js)

(c) i) Define the term lattice energy
ii) Using the data provided, calculate the enthalpy of formation of AgCl from the Bohn Heber cycle.

Sublimation energy for $Ag_{(s)}$	288 kJ mol^{-1}.
First ionization energy for $Ag_{(g)}$	736 kJ mol^{-1}.
Formation energy for AgCl	-125 kJ mol^{-1}
Dissociation energy for $Cl_{2(g)}$	242 kJ mol^{-1}
Electron affinity of $Cl_{2(g)}$	-349 kJ mol^{-1}

2) (a) What do you understand by Valence Shell Electron Pair Repulsion (VSEPR) theory?

(b) Predict the shape of the following molecules using VSEPR theory.

i) BrF_5 ii) $XeOF_4$ iii) OF_2.

(c) Given that,

$$Sn^{++} + 2e \longrightarrow Sn \qquad E^{\theta} = -0.14\ v$$

$$Pb^{++} + 2e \longrightarrow Pb \qquad E^{\theta} = -0.13\ v$$

Calculate the E^{θ} and E of the cell,

Pb/Pb^{2+} (0.001M)// Sn^{2+} (1.0M)/Sn.

PART B

5) (a) Explain the following terms

i) Intensive property

ii) Reversible process

(b) i) Derive the expression for the work done when 'n' moles of an ideal gas expand isothermally and reversibly from volume V_1 to V_2

ii) 2 moles of an ideal gas at the initial pressure of 1atm at 0° C were expanded reversibly under isothermal conditions to a final pressure of 0.1 atm. Calculate the work done by the gas and change in internal energy.

(c) i) Write the mathematical expression of isobaric heat capacity (C_P).

ii) For one mole of an gas, show that $C_P - C_v = R$

6) (a) Derive the following equations for a reversible process

i) $dU = TdS - PdV$

ii) $dA = -PdV - SdT$

iii) $dG = VdP - SdT$

iv) $dA = -PdV - SdT$

(b) i) Write the mathematical expression of second law of thermodynamics.

ii) For an ideal gas, show that the entropy change $\Delta S = C_V \ln\left(\frac{T_2}{T_1}\right) + R \ln\left(\frac{V_2}{V_1}\right)$

(c) Derive the Maxwell relation $\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial S}{\partial P}\right)_T$