EASETRN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE – REPEAT

EXTERNAL DEGREE

FIRST SEMESTER 2003-2004 (OCTOBER 2006)

EXTCH 101 PERIODICITY AND BONDING

Time allowed: **ONE Hour**

Candidate must NOT start writing their answers until told to do so

You may find the following data useful

Avagadro constant (N_A): 6.023×10^{23} mol^{-1}

Electron charge (e): 1.602×10^{-19} C

Faraday constant (F): 9.648×10^{4} Cmol^{-1}

Gas constant (R): 8.314 JK^{-1}mol^{-1}

Planck's constant (h): 6.626×10^{-34} Js

Rest mass of electron (m_e): 9.1×10^{-31} kg

Velocity of light (c): 3×10^{8} ms^{-1}

The use of a non –programmable calculator is permitted

1. (a) (I) Explain the following with an example in each case.
   - (i)   Pauli Exclusion Principle
   - (ii) Hund's Rule

   (30 marks)

   (II) Showing x, y and z axes draw the following orbitals;

   - (i) p_z
   - (ii) $d_{x^2-y^2}$
   - (iii) d_{xy}

   (30 marks)

   (III) A lamp gives out 1.5 kJ of energy in one minute in the form of yellow light of wavelength 580 nm. How many photons of yellow light are generated in one second?

   (28 marks)

   (b) List the values of n,l and m_l for the orbitals in the 4d sub shell.

   (12 marks)

2. (a) Predict the geometry of the following molecules using the concept of hybridization.
   - (i) $HgCl_2$ $(Hg - [Xe]6s^2 4f^{14} 5d^{10})$
   - (ii) AlI_3
   - (iii) PF_5

   (40 marks)

   (b) Predict the shape of HOCl using VSEPR theory.

   (10 marks)

   (c) Write down the molecular orbital configurations of N_2 and N_2^+. Predict the following properties using molecular orbital theory.
   - (i)   Bond order of N_2 and N_2^+.
   - (ii) Magnetic character of N_2 and N_2^+.
   - (iii) Bond length of N_2^+ relative to that of N_2. (Is it shorter or longer). Give reason.
   - (iv) Bond strength of N_2^+ relative to that of N_2. (Is it stronger or weaker). Give reason.

   (50 marks)

End