



**EASTERN UNIVERSITY SRI LANKA  
FIRST EXAMINATION IN SCIENCE  
FIRST SEMESTER-2003/2004 (Proper)  
CH101 PERIODICITY & BONDING**

**Answer all questions**

**Time : 1 Hour**

01. a) Define the following terms

i) Wave length

(ii) Frequency

(iii) Amplitude

(iv) Electromagnetic radiation

b) State Planck's quantum theory.

c) A lamp gives out 1.5kJ of energy in one minute in the form of yellow light of wavelength 580nm. How many photons of yellow light are generated in one second? (Planck's constant =  $6.63 \times 10^{-34}$  Js, speed of the light =  $3 \times 10^8$  ms<sup>-1</sup>)

d) Show that the Bohr radius of the hydrogen atom ( $r$ ) =  $\frac{h^2 \epsilon_0}{\pi m e^2}$

where h – Planck's constant

$\epsilon_0$  – Permittivity of free space

m – Mass of electron

e - Charge of electron

e) Explain the followings:

(i) Pauli's exclusion principle

(ii) Hund's rule

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

b) Predict the shapes of the following molecules using VSEPR theory.

BeCl<sub>2</sub>, CCl<sub>4</sub>, NH<sub>3</sub>, PCl<sub>5</sub>

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

(ii) Write the electronic configuration of phosphorus atom (atomic number 15).

(iii) Give the quantum numbers  $n, l, m_l$  and  $m_s$  for each of the unpaired electrons in the phosphorus atom.

d) The N<sub>2</sub><sup>+</sup> ion can be prepared by bombarding N<sub>2</sub> molecule with fast moving electrons.

Predict the following properties using molecular orbital theory.

i. Molecular orbital electronic configuration of N<sub>2</sub> and N<sub>2</sub><sup>+</sup>.

ii. Bond order of N<sub>2</sub> and N<sub>2</sub><sup>+</sup>.

iii. Magnetic character of N<sub>2</sub> and N<sub>2</sub><sup>+</sup>.

iv. Bond length of N<sub>2</sub><sup>+</sup> relative to that of N<sub>2</sub> (Is it shorter or longer?)

v. Bond strength of N<sub>2</sub><sup>+</sup> relative to that of N<sub>2</sub> (Is it stronger or weaker?)

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