EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE 2005/2006

SECOND SEMESTER (March/April 2008) -PROPER

CH 304 QUANTUM CHEMISTRY AND INDUSTRIAL CHEMISTRY & METALLURGY

Time allowed: **ONE Hour**

Answer all questions.

The use of non-programmable calculator is permitted.

Planck constant (h) = 6.626 X 10^{-34} J s, Rest mass of electron (m_e) = 9.1 x 10^{-31} kg, Gas constant (R) = 8.314 J K^{-1} mol^{-1}

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1. (a) i. Write the general expression for the energy levels of a particle moving in a cubical box and identify all the terms in it.

(10 marks)

ii. Find the lowest energy of an electron in a rectangular box of dimensions 1x10^{-13} cm, 1.5x10^{-13} cm and 2x10^{-13} cm.

(20 marks)

(b) i. The wave function 'ψ' of a particle is given by $\left(\frac{2}{a}\right)^{1/2} \sin\left(\frac{\pi x}{a}\right)$. Determine the probability of the particle which restricted to move in a one – dimensional box of length 'a' is found to be the distance between 0 and $a/2$.

(25 marks)

ii. What is the probability of the particle beyond the distance 'a / 2'

(05 marks)

(c) The molecules $H_2C = CH - (CH = CH)_n - CH = CH_2$, with n = 1, 2, 3.....can be considered as successively longer one – dimensional box for electrons. If it is assume each $C - C$ and $C = C$ bond lengths to be 1.5 $\overset{0}{A}$ and the end $C - H$ bond are neglected, what is the wavelength of absorption of the lowest transition (Take $n = 4$)

(40 marks)

2. (a) Outline the raw materials used in the production of Portland cement and discuss the dry process of manufacture of Portland cement indicating the important steps.

(55 Marks)

(b) Briefly describe the glass forming process.

(45 Marks)

End.