



Eastern University, Sri Lanka

Third Year Second Semester Examination in Science

External Degree-2008/2009

EXTCH 304 Quantum Chemistry and Metallurgy & Industrial Chemistry

Proper and Repeat

Answer all questions

Time Allowed: One hour

$$[h = 6.626 \times 10^{-34} \text{ J s} \quad m_e = 9.1 \times 10^{-31} \text{ kg} \quad R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1} \quad C = 3 \times 10^8 \text{ ms}^{-1}]$$

1. a) Consider a particle free to move in a two-dimensional square plate of side 'a'.
 - i) Write the time independent Schrödinger equation for particle in a two-dimensional motion.
 - ii) Solve the Schrödinger equation to obtain the eigenvalues (E_n) and eigenfunctions (ψ_n). Use the solutions obtained in one-dimensional box model.
 - iii) The molecules $H_2C = CH - (CH = CH)_3 - CH = CH_2$ can be considered as successively longer two - dimensional box for electrons. If each $C - C$ and $C = C$ bond lengths are assumed to be 1.5 \AA and the end $C - H$ bonds are neglected, what is the wavelength of absorption of the lowest transition?
- b) The wave function of a particle is given by $\psi = \sqrt{2/a} \sin\left(\frac{\pi x}{a}\right)$. 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 $a/2$.

2.

- (a) (i) List out the raw materials used in the production of Portland cement
- (i) Discuss the important steps involved in the dry process of manufacture of Portland cement.

(50 Marks)

- (b) "Ceramics are classified as inorganic and non-metallic materials that are essential to our daily life".

- (i) List out the various steps or processes involved in manufacture of ceramics.
- (ii) Describe the each step that you mentioned in (i) with suitable diagram where appropriate

(50 Marks)
