

CEMA(HN)-04

West Bengal State University
B.A./B.Sc./B.Com (Honours, Major, General) Examinations, 2014

PART - II

CHEMISTRY — HONOURS

PHYSICAL CHEMISTRY, CEMAT 24PA, 24PB

Paper - IV

(NEW & OLD SYLLABUS)

Duration : 2 Hours]

[Full Marks : 50

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

(NEW SYLLABUS)

(Use separate answer-script for answering CEMAT-24PA and CEMAT-24PB)

CEMAT-24PA

Answer any two questions taking one from each Unit.

UNIT - I

1. a) Find the value of the commutators $[\hat{x}, \hat{p}_x]$ and $[\hat{x}, \hat{p}_y]$. 3
- b) Calculate the probability that a particle in the ground state will be found between 0.65 L and 0.67 L in a one dimensional box of length L ($0 \leq x \leq L$). [Given : $\psi_1(x) = \sqrt{\frac{2}{L}} \sin\left(\frac{\pi x}{L}\right)$] 3
- c) Show that the wave function, $\psi_0(x)$, defined below, is the eigenfunction of the Hamiltonian operator of a one dimensional harmonic oscillator.
[Given : Potential energy, $u(x) = \frac{1}{2}kx^2$,
$$\psi_0(x) = \left(\frac{\alpha}{\pi}\right)^{1/4} e^{-\alpha x^2/2}$$
 where, $\alpha = \frac{(km)^{1/2}}{\hbar}$
other terms have their usual meaning.] 4
- d) Find the de Broglie wavelength of the electrons that have been accelerated from rest through a potential difference of 40 kV.
[Given : electronic charge, $e = 1.602 \times 10^{-19} \text{C}$, $m_e = 9.109 \times 10^{-31} \text{kg}$] 3

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