

CHEM 332 – TAKE-HOME EXAMINATION 1 – Spring 2021

DATED: March 8, 2021

DUE: March 15, 2021

Note that you may have to look up the values of definite integrals in a table of integrals and also the values of some universal constants.

Please return by email to rghose@ccny.cuny.edu as a **SINGLE** document using your **OFFICIAL CCNY EMAIL ADDRESS**. Make sure that your name, **AS IN YOUR REGISTRATION RECORD**, is clearly written on the document.

Question 1 (30 points)

Consider the following three wave-functions, what are the probabilities of finding the particle in the region given by $0 \leq x \leq 1$.

(a) $\psi(x) = Ae^{-x^2/3}$

(b) $\psi(x) = \frac{B}{x^2+2}$

(c) $\psi(x) = C \operatorname{sech}\left(\frac{x}{5}\right)$

Where A , B and C are normalization constants.

Question 2 (20 points)

Calculate the probability of the transmission of an electron with a kinetic energy 8×10^{-19} J through a barrier of height 1.6×10^{-18} J and width 10 \AA .

Question 3 (50 points)

Consider an un-normalized wavefunction that is given by $\psi(x) = xe^{-x^2/a^2}$. For this particular wavefunction,

- Find the expectation value for the position, x .
- Find the uncertainty in the position, Δx .
- Find the expectation value for the momentum, p .
- Find the uncertainty in the momentum, Δp .
- Show that the Δx and Δp values satisfy the Heisenberg Uncertainty Principle.