Quantum Mechanics and Spectroscopy
CHEM 3PA3
Assignment 2 **Name:** _____

1. For the photoelectric effect, the work function is the minimum energy required to eject an electron. The work function for potassium is 3.69×10^{-19} J. If potassium is irradiated with radiation of 400 nm, determine the maximum kinetic energy that the ejected electrons can reach.

2. In the particle in a one dimesional box model, what is the probability of finding the particle in $a/4 \leq x \leq 3a/4$?

3. Show that the eigenvalues of a Hermitian operator are real.

4. Some textbooks define that a Hermitian operator is one that satisfies $\int \Psi_1^\star(x)\hat{A}\Psi_2(x)\mathrm{d}x = \int \Psi_2(x)(\hat{A}\Psi_1(x))^\star \mathrm{d}x$. Is this equivalent to $\int \Psi^\star(x)\hat{A}\Psi(x)\mathrm{d}x = \int (\hat{A}\Psi(x))^\star \Psi(x)\mathrm{d}x$?

5. For $\hat{A} = x^2$ and $\hat{B} = \frac{d}{dx}$, show that $\hat{A}(\hat{B}f(x)) \neq \hat{B}(\hat{A}f(x))$.

6. If a wavefunction $\Psi(x)$ is solution of the operator $\hat{A}$, show that a constant times the wavefunction is also a solution of $\hat{A}$.