NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 283 – Modern Physics Spring 2025

Problem Set #6

Problem Set Due: Thurs., March 6, 2025
Read Krane: Chapter 7.1-7.5

There will be a Quiz #2 on Tuesday, March 18 (after Spring Break)

1. **OpenStax University Physics Vol. 3: Section 1.3:** Problem 39
2. **OpenStax University Physics Vol. 3: Section 1.4:** Problem 47
3. **OpenStax University Physics Vol. 3: Section 1.5:** Problem 55

4. **Krane: Problem 1** **page 233** (just show calculation)
5. **Krane: Problem 6** **page 233** (just show calculation)
6. **Krane: Problem 8** **page 233** (just show calculation)
7. **Krane: Problem 10** **page 233** (just show calculation)
8. **Krane: Problem 12** **page 234** (***plot radial probability density***)
9. **Krane: Problem 14** **page 234** (just show calculation)

10. Go back to **Krane: Problem 39** on **page 176** and answer part (a):

(a) In the infinite one-dimensional well, what is p_{av} ? (Use a symmetry argument—no calculation necessary)

(b) Calculate the expectation value of p using the operator relation for the momentum explained in class: $\hat{p} = -i\hbar \dfrac{\partial}{\partial x}$ where

$$p_{ave} = \left\langle \hat{p} \right\rangle = \left\langle \psi \left| \hat{p} \right| \psi \right\rangle = \int_{-\infty}^{\infty} \psi(x) \hat{p} \psi^*(x)\, dx$$

note: $\left|\psi(x)\right|^2 = \psi(x)\psi^*(x)$

Does your result agree with part (a)?