

NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 283 – Modern Physics

Spring 2026

Problem Set #6

Problem Set Due: Thurs., March 5, 2026

Read Krane: Chapter 7.1-7.5

There will be a Quiz #2 on Tuesday, March 17

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: $\hat{p} = -i\hbar \frac{\partial}{\partial x}$ where

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

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

Does your result agree with part (a)?