

NORTHERN ILLINOIS UNIVERSITY
PHYSICS DEPARTMENT

Physics 283 – Modern Physics

Fall 2025

Problem Set #6

Problem Set Due: Thurs., Oct 16, 2025

Read Krane: Chapter 7.1-7.5

There will be a Quiz #2 on Tuesday, Oct. 21

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)?