NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 283 – Modern Physics Fall 2025

Problem Set #10

Problem Set Due: Thurs., Dec. 4, 2025
Read Krane: Chapter 11

1. **OpenStax University Physics Vol. 3: Section 2.4:** Problem 61
2. **OpenStax University Physics Vol. 3: Section 2.4:** Problem 63

3. In class we calculated the density of states for a 1 and 3-dimensional particle in a box (see Lecture notes (L#3) on the Physics 283 Website [www.niu.edu/brown]). Using a similar method, calculate the density of states for a 2-dimensional particle in a box. You should find that the density of states is independent of energy. (I give Krane's solution on Blackboard—note: he gives the density of states per unit area)

4. **Krane: Problem 1** **page 384** (explain all your answers—just don't give a number & show figure)

5. **Krane: Problem 3** **page 384** (show calculation)

6. Starting from Equation 10.61, derive Equations 10.62 and 10.63 (make certain to show all your work and derivatives in detail illustrating steps that were skipped in the textbook). *Note: these equations are in **Chapter 10**.*

7. **Krane: Problem 11** **page 384** (show calculation)

8. **Krane: Problem 20** **page 385** (show calculation)

9. **Krane: Problem 22** **page 385** (show calculation)
   Part (b) which one is obviously the better conductor?