

ANSWERS: Quiz: Week 2 Lecture 2
Thermoelectrics from Atoms to Systems
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Answer the **five questions** below by choosing the **one, best answer**.

- 1) Which of the following is true about the Kelvin relation?
 - a) It is a fundamental relation between the electrical and electronic thermal conductivities.
 - b) It is a fundamental relation between the Seebeck and Peltier coefficients.**
 - c) It is an approximate relation between the electrical and electronic thermal conductivities.
 - d) It is an approximate relation between the Seebeck and Peltier coefficients.
 - e) It is a fundamental relation between the electrical conductivity and the Seebeck coefficient.

- 2) Which of the following is true about the Wiedemann-Franz Law?
 - a) It is a material-dependent relation between the electrical and electronic thermal conductivities.**
 - b) It is a material-dependent relation between the Seebeck and Peltier coefficients.
 - c) It is a material-independent relation between the electrical and electronic thermal conductivities.
 - d) It is a material-independent relation between the Seebeck and Peltier coefficients.
 - e) It is a material-dependent relation between the electrical conductivity and the Seebeck coefficient.

- 3) Heat is carried by both electrons and by phonons. Which of the following is true?
 - a) In a metal, $k_e \gg k_L$.
 - b) In a semiconductor, $k_L \gg k_e$.
 - c) In an insulator, $k_L \gg k_e$.
 - d) All of the above.**
 - e) None of the above.

(continued on next page)

Quiz: Week 2 Lecture 2 (continued)

- 4) What is the Lorenz number?
- a) A numerical factor times (k_B/q) that relates the electrical and electronic thermal conductivities in the Wiedemann-Franz Law.
 - b) A numerical factor times $(k_B/q)^2$ that relates the electrical and electronic thermal conductivities in the Wiedemann-Franz Law.**
 - c) A numerical factor times (k_B/q) that relates the Seebeck and Peltier coefficients in the Kelvin relation.
 - d) A numerical factor times $(k_B/q)^2$ that relates the Seebeck and Peltier coefficients in the Kelvin relation
 - e) Another name for the quantum of thermal conductance.
- 5) Which of the following is true about the signs of the Seebeck and Peltier coefficients?
- a) In n-type material, both are positive in sign.
 - b) In n-type materials both are negative in sign.**
 - c) In n-type material, the Seebeck coefficient is negative and the Peltier coefficient positive.
 - d) In n-type material, the Seebeck coefficient is positive and the Peltier coefficient negative.
 - e) In p-type material, the Seebeck coefficient is positive and the Peltier coefficient negative.

End of quiz. This quiz contains 5 questions.