

ANSWERS: Quiz: Week 2 Lecture 6
Thermoelectrics from Atoms to Systems
Mark Lundstrom, nanoHUB-U Fall 2013

Answer the **five questions** below by choosing the **one, best answer**.

1) Which of the equations below is the Boltzmann Transport Equation?

a) $\frac{\partial^2 f}{\partial t^2} + \vec{U} \cdot \nabla_r f + \vec{F}_e \cdot \nabla_p f = 0$

b) $\frac{\partial f}{\partial t} + \vec{U} \cdot \nabla_r^2 f + \vec{F}_e \cdot \nabla_p f = 0$

c) $\frac{\partial f}{\partial t} + \vec{U} \cdot \nabla_p f + \vec{F}_e \cdot \nabla_r f = 0$

d) $\frac{\partial^2 f}{\partial t^2} + \vec{U} \cdot \nabla_p f + \vec{F}_e \cdot \nabla_r f = 0$

e) $\frac{\partial f}{\partial t} + \vec{U} \cdot \nabla_r f + \vec{F}_e \cdot \nabla_p f = 0$

2) What is the “Relaxation Time Approximation” (RTA)?

a) An approximate way to treat the time derivative in the BTE.

b) An approximate way to treat the collision term in the BTE.

c) An approximation that simplifies the spatial part of the BTE.

d) An approximation that simplifies the momentum space part of the BTE.

e) An approximation that reduces 6D phase space to 3D phase space.

3) What are the two driving forces in the BTE?

a) Gradients in electrostatic potential and in the inverse temperature.

b) Gradients in carrier density and in the inverse temperature.

c) Gradients in the electrochemical potential and in the inverse temperature.

d) Gradients in electrostatic potential and in the carrier density.

e) Gradients in carrier density and in the electrochemical potential.

4) Moments of the distribution function involve what?

- a) Integration over position space.
- b) Integration over momentum space (k-space).**
- c) Integration over phase space.
- d) All of the above.
- e) None of the above.

5) What are two key advantages of using the BTE approach?

- a) It is more transparent physically and mathematically simpler.
- b) It can treat spatial variations and magnetic fields.**
- c) It can treat ballistic transport and thermoelectric effects.
- d) It is more rigorous and includes quantum effects.
- e) None of the above.

End of quiz. This quiz contains 5 questions.