Thermoelectricity: From Atoms to Systems

L5.1 Quiz

Answers

1) Which statement is correct regarding thermionic and thermoelectric energy conversions?
   a. Thermionic energy conversion utilizes selective hot electron emission over the barrier at the cathode.
   b. Barrier height in vacuum thermionic energy conversion is workfunction of the cathode metal (if space charge effects can be neglected).
   c. A solid-state thermionic device utilizes band offsets at the hetero-interfaces as barriers for hot electron filtering.
   d. In the linear regime, thermionic transport can be regard as thermoelectric transport with an effective Seebeck coefficient.
   e. All of the above

2) Which of the following strategies can be used for thermoelectric power factor enhancement over bulk?
   a. Enhanced phonon scattering by nanostructures
   b. Phonon dispersion modification by periodic structures
   c. Hot electron filtering
   d. Non-uniform doping in the material
   e. Enhanced electron-boundary scattering in nanostructured materials

3) The Seebeck coefficient in a superlattice can oscillate non-monotonically as a function of carrier density due to…
   a. Carrier confinement inside the potential wells
   b. Mini-band transport
   c. Band bending by charge transfer between wells and barriers
   d. Electron filtering
   e. None of the above

4) To relax the lateral momentum conservation at a planar barrier, which of the following methods can be effective?
   a. Ensure atomically sharp barrier layer
   b. Randomizing the barrier heights
   c. Adding controlled surface roughness
   d. Varying the barrier thickness
   e. Curing the barrier layers at very high temperature