

## Exercise 6.1

*High-temperature thermal conductivity.* At high temperature, the phonon relaxation time in a crystal is

$$\frac{1}{\tau} = \frac{k_B T}{mva}$$

where  $a$  is of the order of distance between atoms and  $m$  is the atomic weight.

- a) Prove that the high-temperature thermal conductivity is proportional to  $1/T$ .
- b) The thermal conductivity of silicon at 300 K is  $145 \text{ W m}^{-1} \text{ K}^{-1}$ . Estimate its thermal conductivity at 400 K.

## Exercise 6.2

*Landauer formulation for electron thermal conduction.* A metallic square nanowire is placed between two thermal reservoirs at temperature  $T_1$  and  $T_2$ . Assume that electron transmissivity is equal to one. Derive an expression for the thermal conductance of the nanowire contributed by the electron.