hw02

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1 Book problem 2.18

In [1]:
```
phys_con = {
    'kB': 8.62e-5, # eV/K
    }

semi_con = {
    'Si':   {'Eg': 1.12, 'B': 1.08e31},
    'Ge':   {'Eg': 0.66, 'B': 2.31e30},
    'GaAs': {'Eg': 1.42, 'B': 1.27e29},
    }


def ni(T, semi='Si'):
    k = phys_con['kB']
    Eg = semi_con[semi]['Eg']
    B = semi_con[semi]['B']

    return sqrt(B * T**3 * exp(-Eg / (k * T)))
```

In [2]:
```
from scipy.optimize import root

# we need a function which is zero at the requested density
def func(T):
    return (1.602e-19 * 150 * ni(T, 'Si')) - 1e3
```

In [3]:
```
# guess pretty hot
out = root(func, x0=1000)
print out['message']
print
print 'Solution:'
print 'conductivity = 10^3 at %.3f K' % (out['x'][0])
```

```
The solution converged.

Solution:
conductivity = 10^3 at 2700.721 K
```

For reference, from the problem, Si melts at 1430K. It would be safe to guess that intrinsic crystalline Si can never be considered a reasonable conductor!