

# PHYS 2380 – Quantum Mechanics 1 – Assignment #1

## Winter 2018

1. The element krypton has an atomic weight of 83.80 kg/kmole. The density of krypton in its 3 states is given in the table below:

State	Density
Solid (at 4 K)	3.09 g/cm <sup>3</sup>
Liquid (at -153 C)	2.155 g/cm <sup>3</sup>
Gas (at 25 C and 1 atmosphere)	3.425 g/l

- a) Calculate the average volume per atom present for each of these states.  
b) Estimate the average distance between the atoms for each of these states.
2. What is the kinetic energy and momentum of an electron that is travelling with a velocity of 0.010 c, 0.10 c, and 0.90 c (where c is the speed of light)?
3. Derive the Wien displacement law using the equation for  $R(\lambda)$  for blackbody radiation given by Planck's theory.
4. A cavity is maintained at a temperature of 2650 K:
- a) At what wavelength is the peak of the radiated energy?  
b) At what rate does the energy escape from a 1.00 mm hole in the walls of the cavity?

*In all cases provide a clear description of your method of calculation. Provide the values you used for any constants.*

Due Jan. 19th, 2018