PH312 Homework 8

1-

Cu density 8.9 g cm^{-3}, melting point: 1356 K, (h-bar)^3 =1.174 10^{-102} Ws^2
k = 1.381 10^{-23} J/K

$$\frac{N\hbar^3}{8V\sqrt{(mkT)^3}} << 1\_is\_the\_conditon$$

putting in numbers, doing the exponent by hand when needed,

11.1 is not << 1, full points if it is also show that the units cancel

2-

(a) From Equation (10.25), using the critical temperature for lead from Table 10.3, the energy gap is

$$E_g(0) = 3.53\,kT = (3.53)\left(8.617 \times 10^{-5}\ \text{eV/K}\right)(7.19\ \text{T}) = 2.19 \times 10^{-3}\ \text{eV}.$$

(b) The frequency of radiation with this energy is

$$f = \frac{\Delta E}{h} = \frac{2.73 \times 10^{-3}\ \text{eV}}{4.136 \times 10^{-15}\ \text{eV}\cdot\text{s}} = 6.60 \times 10^{11}\ \text{Hz},$$

in the microwave or far infrared part of the spectrum (see the back endpapers).

3-

11-1: ${}^{6}_{3}\text{Li}$: $Z = 3$ protons, $A - Z = 6 - 3 = 3$ neutrons.
${}^{22}_{10}\text{Ne}$: $Z = 10$ protons, $A - Z = 22 - 10 = 12$ neutrons.
${}^{94}_{40}\text{Zr}$: $Z = 40$ protons, $A - Z = 94 - 40 = 54$ neutrons.
${}^{180}_{72}\text{Hf}$: $Z = 72$ protons, $A - Z = 180 - 72 = 108$ neutrons.