CH # 41

Examples

#1 monovalent ⇒ 1 electron per atom.

n = number of conduction electrons per unit volume.

number of conduction electrons = number of atoms

$$\text{number of atoms} = \frac{\text{Total mass of sample}}{\text{atomic mass}}$$

$$= \frac{\text{Total mass}}{\frac{\text{molar mass}}{N_A}}$$

$$= \frac{(\rho \times V) N_a}{\text{molar mass}}$$

$$\therefore n = \frac{\text{number of atoms}}{\text{unit volume}}$$

$$= \frac{\rho N_A}{\text{molar mass}}$$

$\rho = 8.96 \frac{g}{cm^3}$, molar mass $= 63.54 \frac{g}{mol}$

#8

$$P(E) = \frac{1}{e^{(E-E_F)/KT} + 1}$$

$$= \frac{1}{e^{\Delta E/KT} + 1}$$

$$e^{\Delta E/KT} = \frac{1}{P(E)} - 1$$

$$= \frac{1}{0.09} - 1$$

$$= 11.11 - 1$$

$$= 10.11$$

$$\Delta E = 63 \times 10^6 \text{ eV}.$$

$$\frac{\Delta E}{KT} = \ln(10.11)$$

$$= 2.41$$

$$\therefore KT = \frac{63 \times 10^6}{2.41}$$

$$= 2.61 \times 10^7 \text{ eV}.$$

To Find $P(E)$ at $E = -63$ MeV

$$P(-63\text{EV}) = \frac{1}{e^{\frac{-63\times10^6}{2.6\times10^7}} + 1}$$

$$= \frac{1}{1.088} = 0.919$$

#17

$E_F = 11.6$ ev

$\rho = 2.7\ g/cm^3$

$M = 27.\ g/mole.$

$n \Leftarrow$ number of conducting electrons per unit volume.

$n' =$ number of conduction electrons / atom

$$\text{Volume} = \frac{\text{Total Mass}}{\rho}$$

$$= \frac{N\ M}{\rho}, \quad N = \text{number of atoms}$$

$$n = \frac{\text{number of conduction electrons}}{N \cdot \frac{M}{\rho}}$$

$\therefore$ number of conduction electrons per atom

$$= n \cdot \frac{\rho}{M}$$

$$n = \frac{16\sqrt{2}\,\pi\, m^3}{3\,h^3} E_F^{\frac{3}{2}}$$

$$\rho = 2.7\ \frac{g}{cm^3} = 2.7 \times 10^6\ \frac{g}{m^3}, \quad M = \frac{27g}{NA}$$