

Tareas 13 Tópicos de la Física Moderna

Martes, 15 de Diciembre 2020

1. Why are most of the elements (about 3/4) metals?
2. What is the relationship between the work function and the Fermi energy of a metal?
3. In 1 g of copper, how many conduction electrons have a kinetic energies in the interval $1 - 2$ eV?
4. The Fermi energy for zinc is 9.39 eV. Calculate the density of conduction electrons. How many conduction electrons are there per atom?
5. The density of calcium ($Z = 20$) is 1.8 times the density of potassium ($Z = 19$). The Fermi energy in potassium is 2.1 eV. Estimate the Fermi energy in calcium.
6. The Fermi energy of aluminum is 11.6 eV. Calculate (a) the Fermi speed and (b) the electronic heat capacity of 1 g of aluminum at room temperature.
7. Determine the temperature where the contribution to the heat capacity from electrons is equal to that from phonons in copper. The Fermi energy of copper is 7.0 eV and the Debye temperature is 343 K.
8. What is the typical energy of a phonon in a copper crystal at room temperature? What is the typical energy of a conduction electron?
9. The mean free path of electrons in a very pure sample of copper at 4 K is about 3 mm. Calculate the resistivity of the sample.
10. Calculate the mobility of electrons in copper at room temperature. Take the conductivity to be $5.9 \cdot 10^7 \Omega^{-1} \text{ m}^{-1}$. Compare the mobility of copper with that of diamond at room temperature (see Figure 14-13 in book).
11. The next element after tin in Group IV of the periodic table is lead. Why is lead not an intrinsic semiconductor?
12. Why doesn't Ohm's law hold for conduction in a diode?
13. Why is diamond transparent to visible light whereas a silicon crystal is not?
14. Why do you think it took 101 years from the time the Hall effect was discovered until the quantized Hall effect was discovered?