Tutorial questions - Lectures 10, 11 & 17

1. Compare the intrinsic electron densities at room temperature of semiconductors with band-gaps of 1, 3 and 5eV.
2. Describe qualitatively whether and how the Fermi level moves with n-doping.
3. How can the energy level of a deep donor (E_d) be determined? Is this better done at high or low temperature? Give reasons.
4. What are the physical dimensions (units) of the diffusion constant?
5. What is the difference between the diffusion constant and the diffusion coefficient?
6. What is the meaning of $2\sqrt{(Dt)}$ in diffusion problems?
7. The Burgers vector of a simple misfit dislocation in fcc materials with lattice constant *a* is given by $\underline{\boldsymbol{b}}=a/2$ [110] and the line direction is $\underline{\xi}$= [1-11]. What type of dislocation is this? Sketch what this Burgers vector describes in an fcc unit cell.
8. If two dislocations, one with $\underline{\boldsymbol{b}}=a/2$[101], $\underline{\xi}$=[11-1] and one with $\underline{\boldsymbol{b}}$=a/2[01-1], $\underline{\xi}$=[111] meet, under what angle do they meet, and what is the Burgers vector of the resulting dislocation?
9. Explain the dependence on the charge carrier density, *n*, of non-radiative and radiative recombinations in materials.
10. In the plot given below, indicate where the purest silicon crystal with the lowest doping is to be found.

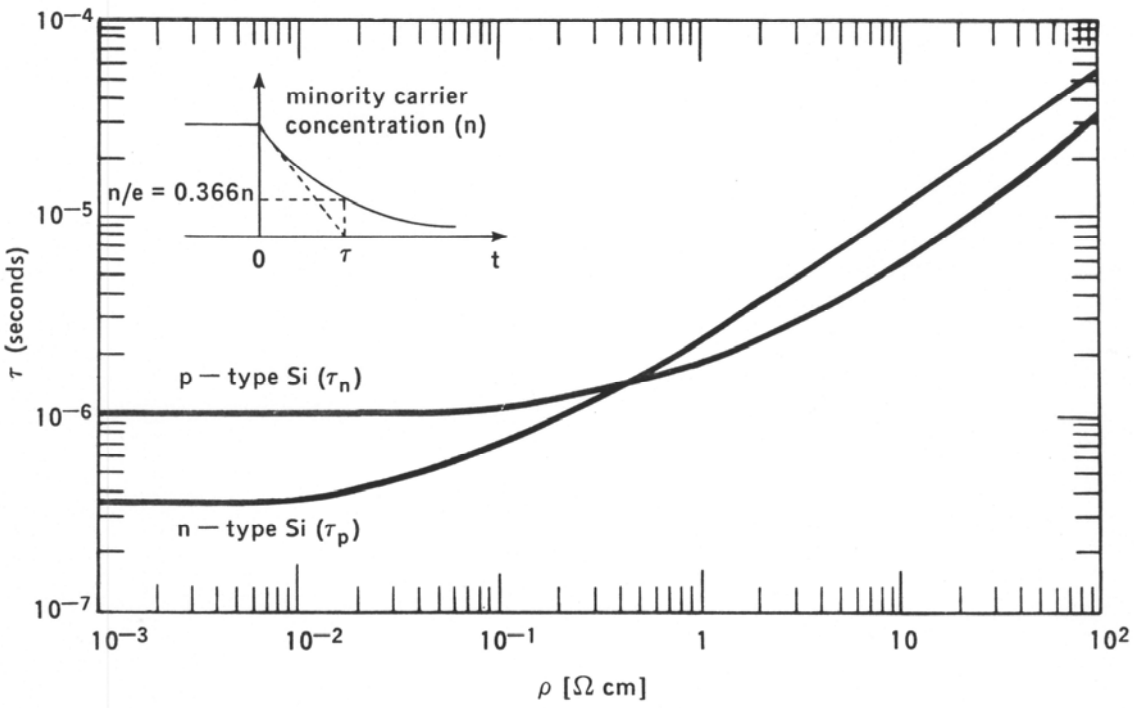

Figure 3-1 — Minority Carrier Lifetime (τ) Versus Resistivity (ρ)[4] (Reprinted with permission from Pergamon Press, Ltd.)