

Homework – Semiconductors

PHY-U371, Electronics, D. Heiman, 10/1/2007

- 1) Consider a slab of material, 0.5mm thick x 3mm wide x 10mm long.
 GaAs has a mobility of 9,200 cm²/Vs at room temperature.
 Si has a mobility of 1,450 cm²/Vs at room temperature.
- a) Compute the resistance of each slab for a carrier density of 2×10^{15} cm⁻³.
 - b) What is the ratio of resistances for the two slabs?
 - c) What carrier density would be needed for Si to match the resistance of the GaAs?
- 2) What is the conduction type (n-type or p-type) for each material and dopant:

- a) Si doped with Al _____
- b) Si doped with Sb _____
- c) GaAs doped with Si on the Ga site _____
- d) GaAs doped with Si on the As site _____
- e) CdTe doped with P on the Te site _____

| II | III | IV | V | VI |
|----|-----|----|----|----|
| | | C | N | |
| | Al | Si | P | S |
| Zn | Ga | Ge | As | Se |
| Cd | In | Sn | Sb | Te |
| Hg | | | | |

- 3) Consider the operating characteristics of a 1N4005 diode in the attached data sheet.
- a) What is power dissipated when operating at the maximum forward current?
 - b) What is power dissipated when operating at the maximum reverse current?
- 4) In a pn junction:
- a) How is the depletion region formed?
 - b) Why is there an electric field in an unbiased junction?