

ENGR 145 Fall 2023
Homework Set #3
Due Wednesday, Sept. 20

CR Questions and Problems:

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- 5.1** The equilibrium fraction of lattice sites that are vacant in silver (Ag) at 700°C is 2×10^{-6} . Calculate the number of vacancies (per meter cubed) at 700°C. Assume a density of 10.35 g/cm³ for Ag.
- 5.46** Electronic devices found in integrated circuits are composed of very high purity silicon to which has been added small and very controlled concentrations of elements found in Groups IIIA and VA of the periodic table. For Si that has had added 6.5×10^{21} atoms per cubic meter of phosphorus, compute **(a)** the weight percent and **(b)** the atom percent of P present.
- 6.6** Briefly explain the concept of *steady state* as it applies to diffusion.
- 6.8** The purification of hydrogen gas by diffusion through a palladium sheet was discussed in Section 6.3. Compute the number of kilograms of hydrogen that pass per hour through a 6-mm thick sheet of palladium having an area of 0.25 m² at 600°C. Assume a diffusion coefficient of 1.7×10^{-8} m²/s, that the respective concentrations at the high- and low-pressure sides of the plate are 2.0 and 0.4 kg of hydrogen per cubic meter of palladium, and that steady-state conditions have been attained.
- 3.103** Would you expect a material in which the atomic bonding is predominantly ionic to be more likely or less likely to form a noncrystalline solid upon solidification than a covalent material? Why? (See Section 2.6.)

Thought question: blackboard chalk has typically been a form of calcium carbonate or limestone, deposited by micro-organisms. Some blackboard chalk is based on gypsum, or calcium sulfate. Suppose that you have a piece of blackboard chalk. Propose an experiment to tell if it is primarily calcium carbonate or calcium sulfate.