CHAPTER 4

4.4 *Calculate the number of vacancies per cubic meter in iron (Fe) at 850°C. The energy for vacancy formation is 1.08 eV/atom. Furthermore, the density and atomic weight for Fe are 7.65 g/cm^3 (at 850°C) and 55.85 g/mol, respectively.*

4.6 *Atomic radius, crystal structure, electronegativity, and the most common valence are given in the following table for several elements; for those that are nonmetals, only atomic radii are indicated.*

Element	***Atomic Radius (nm)***	***Crystal Structure***	***Electronegativity***	***Valence***
Cu	*0.1278*	*FCC*	*1.9*	*+2*
C	*0.071*			
H	*0.046*			
O	*0.060*			
Ag	*0.1445*	*FCC*	*1.9*	*+1*
Al	*0.1431*	*FCC*	*1.5*	*+3*
Co	*0.1253*	*HCP*	*1.7*	*+2*
Cr	*0.1249*	*BCC*	*1.6*	*+3*
Fe	*0.1241*	*BCC*	*1.7*	*+2*
Ni	*0.1246*	*FCC*	*1.8*	*+2*
Pd	*0.1376*	*FCC*	*2.2*	*+2*
Pt	*0.1387*	*FCC*	*1.5*	*+2*
Zn	*0.1332*	*HCP*	*1.7*	*+2*

Which of these elements would you expect to form the following with copper:

(a) A substitutional solid solution having complete solubility

(b) A substitutional solid solution of incomplete solubility

(c) An interstitial solid solution

4.27 Germanium *(Ge) forms a substitutional solid solution with silicon (Si). Compute the number of germanium atoms per cubic centimeter for a germanium-silicon alloy that contains 15 wt% Ge and 85 wt% Si. The densities of pure germanium and silicon are 5.23 and 2.33 g/cm^3, respectively.*

4.35 *Silver (Ag) and palladium (Pd) both have the FCC crystal structure, and Pd forms a substitutional solid solution for all concentrations at room temperature. Compute the unit cell edge length for a 75 wt% Ag–25 wt% Pd alloy. The room-temperature density of Pd is 12.02 g/cm^3, and its atomic weight and atomic radius are 106.4 g/mol and 0.138 nm, respectively.*