PHYS 321 Density change due to expansion and vacancy formation Name:\_\_\_\_\_\_\_\_\_\_\_\_

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19.11 When a metal is heated its density decreases. There are two sources that give rise to this diminishment of ρ: (1) the thermal expansion of the solid, and (2) the formation of vacancies (Section 4.2). Consider a specimen of copper at room temperature (20°C) that has a density of 8.940 g/cm3. (a)Determine its density upon heating to 1000°C when only thermal expansion is considered. (b) Repeat the calculation when the introduction of vacancies is taken into account. Assume that the energy of vacancy formation is 0.90 eV/atom, and that the volume coefficient of thermal expansion, αv is equal to 3αl. [Boltzmann’s constant = k = 8.6173303 × 10−5 eV/K and
*l* for copper is 17.0 × 10-6 (C)-1]