12.8 The zinc blende crystal structure is one that may be generated from close-packed planes of anions.

(a) Will the stacking sequence for this structure be FCC or HCP? Why?

(b) Will cations fill tetrahedral or octahedral positions? Why?

(c) What fraction of the positions will be occupied?

12.26 Compute the theoretical density of ZnS, given that the Zn—S distance and bond angle are 0.234 nm and 109.5°, respectively. How does this value compare with the measured density?

12.36 (a) Suppose that CaO is added as an impurity to Li2O. If the Ca2+ substitutes for Li+, what kind of vacancies would you expect to form? How many of these vacancies are created for every Ca2+ added?

(b) Suppose that CaO is added as an impurity to CaCl2. If the O2– substitutes for Cl–, what kind of vacancies would you expect to form? How many of these vacancies are created for every O2– added?

12.48 Cite one reason why ceramic materials are, in general, harder yet more brittle than metals.

12.52 The flexural strength and associated volume fraction porosity for two specimens of the same ceramic material are as follows:

**(MPa) P**

70 0.10

60 0.15

(a) Compute the flexural strength for a completely nonporous specimen of this material.

(b) Compute the flexural strength for a 0.20 volume fraction porosity.

13.2 (a) What is crystallization?

(b) Cite two properties that may be improved by crystallization.

13.6 Compute the mass fractions of liquid in the following fireclay refractory materials at 1600°C (2910°F):

(a) 25 wt% Al2O3–75 wt% SiO2

(b) 45 wt% Al2O3–55 wt% SiO2

13.12 Compare the softening points for 96% silica, borosilicate, and soda–lime glasses.

13.14For many viscous materials, the viscosity η may be defined in terms of the expression

where σ and dɛ/dt are, respectively, the tensile stress and the strain rate. A cylindrical specimen of a borosilicate glass of diameter 4 mm (0.16 in.) and length 125 mm (4.9 in.) is subjected to a tensile force of 2 N (0.45 lbf) along its axis. If its deformation is to be less than 2.5 mm (0.10 in.) over a week’s time, using Figure 13.12, determine the maximum temperature to which the specimen may be heated.

13.24 (a) Name three factors that influence the degree to which vitrification occurs in clay-based ceramic wares.

(b) Explain how density, firing distortion, strength, corrosion resistance, and thermal conductivity are affected by the extent of vitrification.