Assignment #23

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

σ_{fs} (MPa)	P
100	0.05
50	0.20

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

(b) Compute the flexural strength for a 0.10 volume fraction porosity.

13.5 *Upon consideration of the SiO_2–Al_2O_3 phase diagram in Figure 12.25, for each pair of the following list of compositions, which would you judge to be the more desirable refractory? Justify your choices.*

(a) 20 wt% Al_2O_3–80 wt% SiO_2 and 25 wt% Al_2O_3–75 wt% SiO_2

(b) 70 wt% Al_2O_3–30 wt% SiO_2 and 80 wt% Al_2O_3–20 wt% SiO_2

13.13 *The viscosity η of a glass varies with temperature according to the relationship*

$$\eta = A\exp\left(\frac{Q_{vis}}{RT}\right)$$

where Q_{vis} is the energy of activation for viscous flow, A is a temperature-independent constant, and R and T are, respectively, the gas constant and the absolute temperature. A plot of ln η versus l/T should be nearly linear and have a slope of Q_{vis}/R. Using the data in Figure 13.14,

(a) make such a plot for the borosilicate glass, and

(b) determine the activation energy between temperatures of 50°C and 900°C.

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.