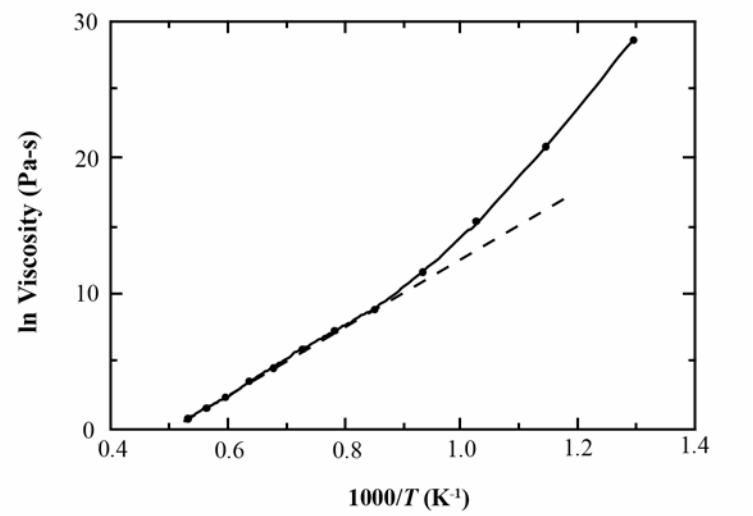
13.13 (a) Below is shown the logarithm viscosity versus reciprocal of temperature plot for the soda-lime glass, using the data in Figure 13.7. The dashed line has been drawn through the data points corresponding to temperatures between 900 and 1600ºC (as stipulated in the problem statement).



(b) The activation energy, Q_{vis}, may be computed according to

$$Q_{vis} = R\left[\frac{\Delta \ln \eta}{\Delta\left(\frac{1}{T}\right)}\right] = R\left(\frac{\ln \eta_1 - \ln \eta_2}{\frac{1}{T_1} - \frac{1}{T_2}}\right)$$

where R is the gas constant, and $\frac{\Delta \ln \eta}{\Delta\left(\frac{1}{T}\right)}$ is the slope of the dashed line that has been constructed. Taking $1/T_1$ and $1/T_2$ as 0.6 x 10^{-3} and 1.10 x 10^{-3} K^{-1}, respectively, then the corresponding values of ln η_1 and ln η_2 are 2.5 and 15.0. Therefore,

$$Q_{vis} = R\left(\frac{\ln \eta_1 - \ln \eta_2}{\frac{1}{T_1} - \frac{1}{T_2}}\right) = (8.31\ \text{J/mol-K})\left(\frac{2.5 - 15.0}{0.6\ \text{x}\ 10^{-3}\ \text{K}^{-1} - 1.10\ \text{x}\ 10^{-3}\ \text{K}^{-1}}\right)$$

$$= 208{,}000\ \text{J/mol}$$