8.35 This problem gives $\dot{\varepsilon}_s$ values at two different temperatures and 140 MPa (20,000 psi), and the value of the stress exponent n = 8.5, and asks that we determine the steady-state creep rate at a stress of 83 MPa (12,000 psi) and 1300 K.

Taking natural logarithms of both sides of Equation 8.20 yields

$$\ln \dot{\varepsilon}_s = \ln K_2 + n \ln \sigma - \frac{Q_c}{RT}$$

With the given data there are two unknowns in this equation--namely K_2 and Q_c. Using the data provided in the problem statement we can set up two independent equations as follows:

$$\ln\left(6.6 \text{ x } 10^{-4} \text{ h}^{-1}\right) = \ln K_2 + (8.5)\ln(140 \text{ MPa}) - \frac{Q_c}{(8.31 \text{ J/mol-K})(1090 \text{ K})}$$

$$\ln\left(8.8 \text{ x } 10^{-2} \text{ h}^{-1}\right) = \ln K_2 + (8.5)\ln(140 \text{ MPa}) - \frac{Q_c}{(8.31 \text{ J/mol-K})(1200 \text{ K})}$$

Now, solving simultaneously for K_2 and Q_c leads to K_2 = 57.5 h^{-1} and Q_c = 483,500 J/mol. Thus, it is now possible to solve for $\dot{\varepsilon}_s$ at 83 MPa and 1300 K using Equation 8.20 as

$$\dot{\varepsilon}_s = K_2 \sigma^n \exp\left(-\frac{Q_c}{RT}\right)$$

$$= \left(57.5 \text{ h}^{-1}\right)(83 \text{ MPa})^{8.5} \exp\left[-\frac{483{,}500 \text{ J/mol}}{(8.31 \text{ J/mol-K})(1300 \text{ K})}\right]$$

$$4.31 \text{ x } 10^{-2} \text{ h}^{-1}$$