Prob. 19.17 - Arrhenius form of t-T shifting equation

General Arrhenius expression for relaxation time:

$$\tau = \tau_0 \exp \frac{E^*}{RT}$$

Base-10 logarithmic form:

$$\log \tau = \log \tau_0 + \frac{E^*}{2.303RT}$$

Logarithmic form at reference temperature:

$$\log \tau_{\text{ref}} = \log \tau_0 + \frac{E^*}{2.303R T_{\text{ref}}}$$

Subtracting these two expressions:

$$\log \tau - \log \tau_{\text{ref}} \equiv \log a_r = \frac{E^*}{2.303R} \left( \frac{1}{T} - \frac{1}{T_{\text{ref}}} \right)$$

Prob. 19.18 - Time-temperature equivalence

\[ E = \text{slope} \times 2.303 \times R \]
\[ = 222 \text{ kJ/mol} \]