The problem stipulates that $x = 0.65$ mm $= 6.5$ x 10^{-4} m. Therefore

$$\frac{6.5 \times 10^{-4} \text{ m}}{2\sqrt{Dt}} = 0.4002$$

Which leads to

$$Dt = 6.59 \text{ x } 10^{-7} \text{ m}^2$$

Furthermore, the diffusion coefficient depends on temperature according to Equation 5.8; and, as noted in Design Example 5.1, $D_0 = 2.3$ x 10^{-5} m^2/s and $Q_d = 148,000$ J/mol. Hence

$$Dt = D_0 \exp\left(-\frac{Q_d}{RT}\right)(t) = 6.59 \times 10^{-7} \text{ m}^2$$

$$(2.3 \times 10^{-5} \text{ m}^2/\text{s}) \exp\left[-\frac{148,000 \text{ J} / \text{mol}}{(8.31 \text{ J} / \text{mol - K})(T)}\right](t) = 6.59 \times 10^{-7} \text{ m}^2$$

And solving for the time t

$$t \text{ (in s)} = \frac{2.86 \times 10^{-2}}{\exp\left(-\frac{17,810}{T}\right)}$$

Thus, the required diffusion time may be computed for some specified temperature (in K). Below are tabulated t values for three different temperatures that lie within the range stipulated in the problem.

Temperature	Time	
(°C)	s	h
1000	34,100	9.5
1100	12,300	3.4
1200	5,100	1.4