Calculate the concentration of carboxyhemoglobin at the beginning of the uptake phase using the fraction of carboxyhemoglobin in the blood of a non-smoker listed in Table 2.

$\%COHb_A := 0.75\,\%$ $\quad COHb_A := \%COHb_A \cdot Hf \cdot Hb$ $\quad COHb_A = 0.001635$

Calculate the diffusion rate for an employee who is performing moderate work during the uptake phase with Equation 20 and the appropriate value from Table 1.

$\dot{D}_{L.u} := 30\ \frac{mL}{min\ mmHg}$ $\quad D_{L.u} := \frac{\dot{D}_{L.u}}{1 + 0.0031 \cdot \left(x_{O2} \cdot \left(\frac{P_B - P_{H2O}}{mmHg} \right) - 150 \right)}$ $\quad D_{L.u} = 31.24665\ \frac{mL}{min\ mmHg}$

Calculate the alveolar ventilation for an employee who is performing moderate work during the uptake phase with Equation 21 and the appropriate value from Table 1.

$\dot{V}_{A.u} := 18\ \frac{L}{min}$ $\quad V_{A.u} := \dot{V}_{A.u} \cdot \left(\frac{P_B - P_{H2O}}{760\ mmHg} \right) \cdot \left(\frac{273.15\ K}{310.15\ K} \right)$ $\quad V_{A.u} = 13.62077\ \frac{L}{min}$

Calculate β for the uptake phase with Equation 2.

$\beta_u := \frac{1}{D_{L.u}} + \left(\frac{P_B - P_{H2O}}{V_{A.u}} \right)$ $\quad \beta_u = 4.796696\ \frac{mmHg\ sec}{mL}$

Since the partial pressure of inspired carbon monoxide and the mean pulmonary capillary oxygen pressure are both dependent upon the concentration of CO and this is what we seek as a solution these parameters must be defined as function of CO concentration.

$P_{I.co.u}(x_{co}) := x_{co} \cdot (P_B - P_{H2O})$ $\quad P_{C.o2.u}(x_{co}) := x_{o2} \cdot (P_B - P_{H2O} - P_{I.co.u}(x_{co})) - \Delta P_a$

Similarly Q, R, and S for the uptake phase are dependent upon the concentration of CO.

$Q_u(x_{co}) := \beta_u \cdot M \cdot V_{co} + M \cdot P_{I.co.u}(x_{co}) + P_{C.o2.u}(x_{co})$

$R_u(x_{co}) := Hf \cdot Hb \cdot P_{C.o2.u}(x_{co})$

$S_u(x_{co}) := Hf \cdot Hb \cdot M \cdot (V_{co} \cdot \beta_u + P_{I.co.u}(x_{co}))$

Use a nonlinear equation solver with Equation 14 to find the concentration of carbon monoxide during the uptake phase. But first we bound the solve function with Equation 22.

$\Delta t_u := 240\ min$

$x_{co.L} := \frac{\left(\beta_u \cdot M \cdot V_{co} + (P_B - P_{H2O}) \cdot x_{o2} - \Delta P_a \right) \cdot COHb_B - V_{co} \cdot \beta_u \cdot Hf \cdot Hb \cdot M}{\left(Hf \cdot Hb \cdot M - COHb_B \cdot (M - x_{o2}) \right) \cdot (P_B - P_{H2O})}$ $\quad x_{co.L} = 149.9035\ ppm$

$x_{co.H} := 1.3 \cdot x_{co.L}$ $\quad x_{co.H} = 194.8745\ ppm$

$x_{co.e} := solve\left(\ln\left(\frac{COHb_A \cdot Q_u(x_{co}) - S_u(x_{co})}{COHb_B \cdot Q_u(x_{co}) - S_u(x_{co})} \right) = \frac{Q_u(x_{co})}{R_u(x_{co})} \cdot \left(\frac{\Delta t_u \cdot Q_u(x_{co})}{V_b \cdot \beta_u \cdot M} + COHb_A - COHb_B \right), x_{co}, x_{co.L}, x_{co.H} \right)$

$x_{co.e} = 193.7957\ ppm$