Define the Haldane constant, the binding capacity of hemoglobin, the vapor pressure of water at body temperature, and endogenous carbon monoxide production rate, and the oxygen pressure differential between the saturated alveoli and the pulmonary capillaries as constants.

$M := 218 \qquad Hf := 1.38\ \frac{mL}{g} \qquad P_{H2O} := 47\ mmHg \qquad V_{CO} := 0.007\ \frac{mL}{min} \qquad \Delta P_a := 49\ mmHg$

Calculate the partial pressure of inspired carbon monoxide during the elimination phase with Equation 18 from the ambient pressure and the fraction of carbon monoxide in the air

$P_B := 700\ mmHg \qquad x_{CO} := 4\ ppm \qquad P_{I.CO.e} := x_{CO} \cdot (P_B - P_{H2O}) \qquad P_{I.CO.e} = 0.002612\ mmHg$

Calculate the mean pulmonary capillary oxygen pressure during the elimination phase with Equation 19 from the fraction of oxygen in the air.

$x_{O2} := 21\ \% \qquad P_{C.O2.e} := x_{O2} \cdot (P_B - P_{H2O} - P_{I.CO.e}) - \Delta P_a \qquad P_{C.O2.e} = 88.12945\ mmHg$

Calculate the diffusion rate for an employee who is resting during the elimination phase with Equation 20 and the appropriate value from Table 1.

$D`_{L.e} := 20\ \frac{mL}{min\ mmHg} \qquad D_{L.e} := \frac{D`_{L.e}}{1 + 0.0031 \cdot \left(x_{O2} \cdot \left(\frac{P_B - P_{H2O}}{mmHg}\right) - 150\right)} \qquad D_{L.e} = 20.8311\ \frac{mL}{min\ mmHg}$

Calculate the alveolar ventilation for an employee who is resting during the elimination phase with Equation 21 and the appropriate value from Table 1.

$V`_{A.e} := 6\ \frac{L}{min} \qquad V_{A.e} := V`_{A.e} \cdot \left(\frac{P_B - P_{H2O}}{760\ mmHg}\right) \cdot \left(\frac{273.15\ K}{310.15\ K}\right) \qquad V_{A.e} = 4.540255\ \frac{L}{min}$

Calculate β for the elimination phase with Equation 2.

$\beta_e := \frac{1}{D_{L.e}} + \left(\frac{P_B - P_{H2O}}{V_{A.e}}\right) \qquad \beta_e = 11.509780\ \frac{mmHg\ sec}{mL}$

Calculate Q, R, and S for the elimination phase with Equations 11, 12, and 13 from amount of hemoglobin in the blood.

$Hb := 15.8\ \frac{gram}{100\ mL} \qquad Q_e := \beta_e \cdot M \cdot V_{CO} + M \cdot P_{I.CO.e} + P_{C.O2.e} \qquad Q_e = 88.99160\ mmHg$

$R_e := Hf \cdot Hb \cdot P_{C.O2.e} \qquad R_e = 19.21575\ mmHg$

$S_e := Hf \cdot Hb \cdot M \cdot (V_{CO} \cdot \beta_e + P_{I.CO.e}) \qquad S_e = 0.187983\ mmHg$

Calculate the concentration of COHb in the blood from the measured fraction of COHb in the blood when it was measured.

$\%COHb_C := 15\ \% \qquad COHb_C := \%COHb_C \cdot Hf \cdot Hb \qquad COHb_C = 0.032706$

Use a nonlinear equation solver with Equation 10 to find the COHb concentration at the begining of the elimination phase from the duration of the elimination phase and the volume of blood in the body.

$\Delta t_c := 120\ min \qquad V_b := 5\ L$

$$COHb_B := solve\left(\ln\left(\frac{COHb_B \cdot Q_e - S_e}{COHb_C \cdot Q_e - S_e}\right) = \frac{Q_e}{R_e} \cdot \left(\frac{\Delta t_c \cdot Q_e}{V_b \cdot \beta_e \cdot M} + COHb_B - COHb_C\right), COHb_B, COHb_C, 3 \cdot COHb_C\right)$$

$COHb_B = 0.04270695$

Calculate the percent COHb in the blood at the beginning of the elimination phase.

$\%COHb_B := \frac{COHb_B}{Hf \cdot Hb} \qquad \%COHb_B = 19.58675\ \%$