ORIGIN := 1

Part (a)

$y_{CO} := 0.1$ $y_{H2} := 0.3$ $y_{CH4} := 0.1$ $y_{H2O} := 0.3$ $y_{CO2} := 0.1$ $n := 5$

Given

$$2.283 = \frac{y_{CO} \cdot y_{H2}}{y_{H2O}} \cdot 5$$

$$0.043 = \frac{y_{CH4} \cdot y_{H2O}}{y_{CO} \cdot y_{H2}^{3}} \cdot \frac{1}{5^{2}}$$

$$1.450 = \frac{y_{CO2} \cdot y_{H2}}{y_{CO} \cdot y_{H2O}}$$

$$y_{CH4} + y_{H2O} + y_{CO} + y_{H2} + y_{CO2} = 1$$

$$2y_{CO2} + y_{CO} + y_{H2O} = \frac{1}{n}$$

$$2y_{H2} + 2y_{H2O} + 4y_{CH4} = \frac{37}{n}$$

$$\text{Find}\left(y_{CH4}, y_{H2}, y_{CO}, y_{H2O}, y_{CO2}, n\right) = \begin{pmatrix} 0.239 \\ 0.698 \\ 0.024 \\ 0.037 \\ 1.895 \times 10^{-3} \\ 15.258 \end{pmatrix}$$

Part (b)

$y_{CO} := 0.1$ $y_{H2} := 0.3$ $y_{CH4} := 0.1$ $y_{H2O} := 0.3$ $y_{CO2} := 0.1$ $n := 5$

Given

$$0.039 = \frac{y_{CO} \cdot y_{H2}}{y_{H2O}} \cdot 2.5$$

$$36.346 = \frac{y_{CH4} \cdot y_{H2O}}{y_{CO} \cdot y_{H2}^{3}} \cdot \frac{1}{2.5^{2}}$$

$$4.234 = \frac{y_{CO2} \cdot y_{H2}}{y_{CO} \cdot y_{H2O}}$$

$$y_{CH4} + y_{H2O} + y_{CO} + y_{H2} + y_{CO2} = 1$$

$$2y_{CO2} + y_{CO} + y_{H2O} = \frac{1}{n}$$

$$2y_{H2} + 2y_{H2O} + 4y_{CH4} = \frac{9}{n}$$

$$\text{Find}\left(y_{CH4}, y_{H2}, y_{CO}, y_{H2O}, y_{CO2}, n\right) = \begin{pmatrix} 0.396 \\ 0.334 \\ 0.011 \\ 0.229 \\ 0.031 \\ 3.323 \end{pmatrix}$$