8. $4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(g)}$

a) $\frac{3.5\,mol}{4L} = 0.875\,mol/L$ $\qquad$ $\frac{1.6\,mol}{4L} = 0.4\,\frac{mol}{L}$

$$avg.\ rate = \frac{\Delta[C]}{\Delta t} = \frac{\left(0.4\frac{mol}{L} - 0.875\frac{mol}{L}\right)}{180s - 0s} = -2.6\times10^{3}\frac{mol}{L\cdot s}$$

∴ the average rate of reaction with respect to NH_3 is $-2.6\times10^{3}\frac{mol}{L\cdot s}$

b) $$rate = -\frac{1}{4}\frac{[NH_3]}{\Delta t} = \frac{1}{6}\frac{[H_2O]}{\Delta t}$$

$$\frac{6\cdot\left(-\frac{1}{4}\left[-2.6\times10^{3}\frac{mol}{L\cdot s}\right]\right)}{\Delta t} = \frac{\frac{1}{6}\frac{[H_2O]}{\Delta t}}{\frac{1}{6}}$$

$$0.0039583\frac{mol}{L\cdot s} = [H_2O]$$

$$3.9\times10^{-3}\frac{mol}{L\cdot s} = [H_2O]$$

∴ the rate of formation for H_2O is $3.9\times10^{-3}\,mol/L\cdot s$