$2\,CH_3OH + 3\,O_2 \rightarrow 2\,CO_2 + 4\,H_2O$

L.R. problem:

$$8.40\text{ mL} \times \frac{0.7918\text{ g } CH_3OH}{\text{mL}} \times \frac{1\text{ mol } CH_3OH}{32.05\text{ g } CH_3OH} \times \frac{2\text{ mol } CO_2}{2\text{ mol } CH_3OH} = 0.209 \text{ mol } CO_2$$

$$n = \frac{PV}{RT} \quad \frac{.9803\text{ atm}(18.9\text{ L})}{.0821\frac{\text{L atm}}{\text{mol K}}\,293.15\text{ K}}(0.210) \times \frac{2\text{ mol } CO_2}{3\text{ mol } O_2} = .108 \text{ mol } CO_2$$

Oxygen limits!

$$\frac{.9803\text{ atm}(18.9\text{ L})}{.0821\frac{\text{L atm}}{\text{mol K}}(293.15)}(.210\text{ mol } O_2) \times \frac{2\text{ mol } CH_3OH}{3\text{ mol } O_2} \times \frac{-715.0\text{ kJ}}{\text{mol } CH_3OH} \times \frac{1000\text{ J}}{\text{kJ}}$$

$= -77{,}100\text{ J}$ (released)

$$\text{moles of Air} = \frac{18.9\text{ L}(.9803\text{ atm})}{.0821\frac{\text{L atm}}{\text{mol K}}(293.15\text{ K})} = 0.770 \text{ mol Air}$$

$$0.770\text{ mol Air} \times \frac{29.00\text{ g Air}}{\text{mol Air}} = 22.3\text{ grams Air}$$

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(1) $-77{,}100\text{ J} = -[mc\Delta T_{Air}]$ $\quad -77{,}100\text{ J} = -\left[22.3\text{ g}\,1.0035\frac{\text{J}}{\text{g}^\circ\text{C}}\,\Delta T\right]$

$-77{,}100\text{ J} = -\left[22.4\frac{\text{J}}{^\circ\text{C}}\,\Delta T\right]$ $\quad \frac{-77{,}100\text{ J}}{-22.4\frac{\text{J}}{^\circ\text{C}}} = \Delta T = 3{,}440\,^\circ\text{C}$

$\Delta T = T_f - T_i$ $\quad$ So $\boxed{3460\,^\circ\text{C}} = T_f$ $\quad 3460 + 273 = 3730\text{ K}$.

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(2) $P = \frac{nRT}{V}$ $\quad \frac{0.770\text{ mol}(.0821\text{ L atm/mol K})3730\text{ K}}{18.9\text{ L}} = \boxed{\cancel{11.6\text{ atm}}}$

12.5 atm.