

M3.9 (ES.8a, 7th)

$$n = 2.00 \text{ mL}, T = 330 \text{ K}, p = 3.50 \text{ atm} \quad \begin{array}{l} \text{isothermal} \\ \text{compression} \end{array} \quad \begin{array}{l} \Delta T = 0 \\ \Delta U = 0 \end{array}$$

$$\Delta S = -25.0 \text{ J K}^{-1}$$

(a) final pressure:

$$\Delta S = nR \ln\left(\frac{V_f}{V_i}\right) = nR \ln\left(\frac{P_i}{P_f}\right)$$

$$\frac{P_i}{P_f} = e^{\Delta S/nR}, \quad \therefore P_f = P_i e^{-\Delta S/nR}$$

$$P_f = 3.50 \text{ atm} \exp\left(-\left[-25.0 \text{ J K}^{-1} / 2.00 \text{ mL} / 8.314 \text{ J K}^{-1} \text{ mL}\right]\right)$$

$$P_f = \boxed{15.7 \text{ atm}}$$

(b)  $\Delta G$

$$\Delta G = nRT \ln\left(\frac{P_f}{P_i}\right) = -T\Delta S \quad (\Delta H = 0, \text{ const } T, \text{ p.g.})$$

$$\Delta G = (-330 \text{ K})(-25.0 \text{ J K}^{-1}) = 8250 \text{ J} = \boxed{8.25 \text{ kJ}}$$

A large rectangular area with a black border, containing 20 horizontal light blue lines for writing or drawing.