

Callen

3.4-3 From $PV = nRT$,

$$P_1 = \frac{2R \times 273}{(0.1)^3 \cdot 45} \approx \boxed{0.1 \text{ MPa}}$$

$dk = 0$ means $Tds = 0 \Rightarrow ds = 0$.

$$\Rightarrow cR \ln\left(\frac{V_f}{V_0}\right) + R \ln\left(\frac{P_f}{P_0}\right) = 0$$

$$\frac{3}{2} \ln\left(\frac{\frac{3}{2} nRT_f}{\frac{3}{2} nRT_i}\right) + \ln\left(\frac{V_f}{V_0}\right) = 0$$

$$\frac{3}{2} \ln\left(\frac{2 \cdot 273}{273}\right) + \ln\left(\frac{V_f}{V_0}\right) = 0$$

$$\frac{3}{2} (-0.2023) + \ln\left(\frac{V_f}{V_0}\right) = 0$$

$$\ln\left(\frac{V_f}{V_0}\right) = 0.3034$$

$$\frac{V_f}{V_0} = 1.3544$$

$$1.3544 \times 45 \text{ liters} = 60.95 \text{ liters}$$

$$\approx \approx 61 \times (10^{-1})^3 \text{ m}^3$$

$$\approx \boxed{61 \times 10^{-3} \text{ m}^3}$$